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ABSTRACT

This report summarizes research findings which resulted in development of curricula for occupational safety and health professions based on task/activity analyses and related performance objectives. The first seven chapters focus on the seven objectives. Chapter 1, Literature Review and Selection of Employers, concerns tasks required for determining employment requirements in two occupational safety and health occupations: Industrial Hygienists and Safety Professionals. Chapter 2, concerning selection of advisory committee and expert practitioners, development and approval of task/activity analysis survey form, and practitioner survey, describes tasks required to determine practitioner-defined knowledge and skill requirements. Chapter 3 analyzes incumbent data, while chapter 4 reports activities to correlate, merge, and consolidate data to derive job requirements. Chapter 5 reports certification requirements and makes recommendations to modify certifying procedures. Chapter 6 concerns development of behavioral objectives based on task/activity analysis and recommendation of alternate training/education routes. Chapter 7 describes development of task-oriented curricula. In chapter 7 and appendixes are associate-level curricula for occupational health and safety technicians, "certificate"/curricula for occupational health and for occupational safety, baccalaureate curriculum for industrial hygienists and safety professionals, and suggestions for occupational health and safety generalist baccalaureate curriculum and graduate-level education. (YLB)

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TECHNICAL REPORT XII

FINAL REPORT

Development and Validation of Career Development Guidelines by Task/Activity Analysis of Occupational Safety and Health Professions: Industrial Hygiene and Safety Professional

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Contract CDC-99-74-94

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FORWARD

This Report is in partial fulfillment of Contract No. CDC-99-74-94; Development and Validation of Career Development Guidelines by Task/Activity Analysis of Occupational Safety and Health Professions. The terminal objective of the contract was the development of curricula based on the task/activity analyses and related performance objectives. This Report includes an Associate level curriculum developed for Occupational Health and Safety Technicians, "certificate" curricula for Occupational Health and for Occupational Safety, Baccalaureate curricula for the preparation of Industrial Hygienists and Safety Professionals, suggestions for an "occupational health and safety generalist" Baccalaureate curriculum and suggestions for Graduate level education.

ACKNOWLEDGMENT

The Project Staff wishes to acknowledge, with appreciation, the cooperation of 213 companies for permitting their personnel in occupational safety and health to provide individual responses to the Task/Activity Analysis Survey Form. The anonymity retained by these Contact Persons and Incumbents does not, in any way, reduce their contribution to this project. It could not have been completed without their assistance.

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The Staff also wishes to thank the American Board of Industrial Hygiene and the Board of Certified Safety Professionals for their assistance and interest in this project.

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INTRODUCTION

This final report presents the results of the contract NIOSH-CDC-99-74-94; Development and Validation of Career Development Guidelines by Task/Activity Analysis of Occupational Safety and Health Professions. Perhaps the purpose of the research can be best summarized by excerpting and paraphrasing the "Description of Work" stated in the contract.

The contractor was required to develop the guidelines by accomplishing these objectives:

To determine the education, training and experience requirements in private industry for the employment of two selected occupational safety and health professional categories; *Industrial Hygiene* and *Safety Professional*.

To determine the knowledge and skill requirements for these two categories as defined by a select group of Expert Practitioners, i.e., to determine "optimum tasks requirements." Optimum tasks requirements were to include the tasks/activities "to be completed by individuals certified in an occupational safety and health occupation, individuals in training to become certified, and individuals at the technician level." In addition, the Expert Practitioners were to determine the knowledge required to perform the tasks/activities successfully.

To complete task and activity analyses associated with occupational health and safety occupations in private industry by securing and analyzing data from a representative sample of individuals employed at various occupational levels, i.e., the Incumbents. The sample of Incumbents was to represent the occupational levels, be representative of SIC classifications, be a random selection to provide an unbiased response to the Task/Activity Analysis Survey Form, and provide an educational/training/certification profile of the occupational levels.

To correlate, merge and modify the data received from the Expert Practitioners and the Incumbents to "arrive at practical and reasonable job requirements." This included appropriate statistical analysis of the data provided by the Expert Practitioners and the Incumbents and the determination of differences, if any, between the data provided by the two groups. The analyses were directed toward determining the tasks/activities to be performed and the preferred knowledge requirements.

To study present certification procedures for the two professional categories and to determine if the requirements are comparable to the task/activity requirements and the education/training requirements for certification. In addition, it was required to determine if any alternate methods to certification were appropriate.

To develop behavioral (performance) objectives based on the task/activity analyses and to recommend alternate education/training routes in preparing individuals to "proficiently complete tasks and activities in the three occupational levels and advance toward certification via educational/training routes, if appropriate."

To develop task/activity oriented curricula, including curricula units, which will produce the skills and knowledge required to perform the specific tasks/activities involved in the occupational levels within the two professional categories.

This final report summarizes the results of the research. Other reports completed under this contract are cited throughout this final document. The reader is encouraged to refer to those reports, including the respective appendices, when appropriate.

CHAPTER I

LITERATURE REVIEW AND EMPLOYER SELECTION

Objective I.

To determine current personnel requirements (education, training, and experience) for the employment of two selected occupational safety and health occupations; Industrial Hygienists and Safety Professionals.

Two tasks were associated with this objective; (1) Review of Literature and (2) Selection of Employers.

(1) Review of Literature

Limited information was found in the literature to substantiate the education, training and experience requirements for *Industrial Hygienists* and *Safety Professionals*. Technical literature studied included the American Industrial Hygiene Association Journal, the American Society of Safety Engineers Journal (and its replacement, Professional Safety), the Journal of the American Society for Engineering Education, and Transactions of the American Conference of Governmental Industrial Hygienists. Some information suggesting personnel requirements was inherent in some published curricula. No publications were identified that used the task/activity analysis concept to identify the education/training requirements for Industrial Hygienists and Safety Professionals.

Therefore, permission was granted by the sponsor to complete a study of industrial hygiene and safety personnel employed by State and Local governments in an effort to determine personnel requirements as published in job descriptions. Accordingly, job descriptions were requested from State and Local governmental agencies identified in the 1975 Occupational Safety and Health Directory published by the U. S.

Department of Health, Education, and Welfare. When education and experience requirements are considered, the study of State and Local government requirements can be summarized as follows.

In the *Industrial Hygiene* category, the IH Technician, the IH In Training and the IH Professional were considered. By classifications, the following statements can be made:

(1) the Technician level differs from the In Training and Professional levels in education (i.e., Technician requires a mean of four (4) years less education); and differs from the In Training level in experience (i.e., Technician requires a mean of about 3.5 years more experience).

(2) the In Training level does not differ from the professional level in education, but does differ in experience (i.e., In Training requires a mean of about 3.5 years less experience).

(3) the Professional level does not differ from the In Training level in education or from the Technician level in experience.

Insofar as the *Safety Professional* category is concerned, the following conclusions are drawn:

(1) the Technician level differs from both the In Training and Professional levels in education (i.e., Technician requires about one (1) year less than In Training and about three (3) years less than Professional), and in experience (i.e., Technician requires about 3.5 years less than in Training and Professional).

(2) the In Training level differs from the Professional level in education (i.e., In Training requires about two (2) years less than Professional), but not in experience (i.e., both require approximately five (5) years).

(3) the Professional level requires more education than both the In Training and Technician levels, but requires the same experience as the In Training level.

When these classifications are considered in the State and Local government context, it may be concluded that the IH In Training level is a preliminary step to the terminal IH Professional level since the only difference between them is the 3.5 years more experience for the Professional. The IH Technician level appears to be a terminal level since the mean years of education is four (4) years less and the mean years of experience 3.5 years more than the IH In Training level. This does not preclude the opportunity for the Technician from reaching the other levels by obtaining the necessary education.

Insofar as State and Local governmental classification are concerned, it may be concluded that the SP In Training level is a preliminary step to the terminal SP Professional level since the only difference between them is the approximately two (2) years more education for the Professional. The SP Technician level may be considered a preliminary step to the In Training level for it requires both more education (about one (1) year) and more experience (about 2.5 years) to step from the Technician to the In Training level.

The total results of the study can be found in Appendix I of this final report. The Review of Literature, including the study of job descriptions received from State and Local governments, was helpful in determining the content of the Task/Activity Analysis Survey Form to be developed in this project.

(2) Selection of Employers

The procedure used in determining employers whose employees (incumbents) would be requested to participate in this project was patterned after the recommended procedure detailed in the report Feasibility Study Covering Nationwide Occupational Safety and Health Manpower Survey. The study reported by Short was a pilot survey of 274 firms and organizations employing fifty (50) or more workers and eight (8) worker's compensation insurance carriers. The sample matrix evaluated included four (4) regional, six (6) industrial, four (4) size-of-firm, and two (2) size-of-city strata. Only two (2) strata (size-of-firm and type of industry) were found to be significant. From the analysis of the pilot survey, Short recommended:

1. Omit firms employing less than 100 due to low incidence of occupational safety and health personnel. It was found that all firms in the 100-499 employee size exhibited similar occupational safety and health manpower patterns in a given industry.
2. The six (6) SIC's (type of industry--Standard Industry Classification) were sufficient except in the government sector. (Since this project was concerned with Industry personnel, governmental personnel were excluded.)

Following the recommendations in Short's study, a population of "contact persons" was identified from existing rosters of professional organizations. (The rosters identified individual members and their employer.)

Each "contact person" selected was a potential participant both as a respondent and as an individual through whom the Task/Activity Analysis Survey Form could be distributed to other individuals employed in the occupational category of interest within the "contact person's" company.

The population for each category is described as follows:

Industrial Hygiene - The 1974-75 American Industrial Hygiene Association (AIHA) membership roster excluding those designated as nonpractitioners (i.e., university professors, practicing medical doctors, and individuals with no company affiliation). A total of 633 individuals were identified as the population from which the sample was selected.

Safety Professional - Membership rosters 1974-75 of the American Society of Safety Engineers including individuals designated as Professional Member or Member only were obtained. A total of 4,377 individuals were identified as the population. Since only approximately 50 percent of the membership rosters were available to the study, the population total is estimated from those available rosters.

In order to define a stratified sample for each category, the members of each population were classified according to company name and the appropriate SIC code number obtained from Standard and Poor's Registry for 1973. The six (6) SIC's were treated by an analysis of variance to determine the number of respondents needed in each cell of the sampling matrix. Table I-1 gives the SIC, population size, sample size needed for representation, and the number of respondents for each occupational category. In all strata, the number of respondents in the sample was equal to or greater than the recommended cell size in Short's feasibility study. Additional individuals were sampled to provide for a higher response level.

The list of "contact persons" selected as a sample from the identified population was obtained by stratifying the companies represented into the six (6) SIC's. A random number table was then used to select individuals to serve as Contact Persons from each of the stratified groups. Thus, the sample of employers was identified through Contact Persons whose names were listed in the rosters of professional organizations, i.e., the American Industrial Hygiene Association and the American Society of Safety Engineers. The employers, or companies, were assigned to the proper SIC code number as obtained from Standard and Poor's Registry for 1973. Individual Incumbents were selected by the Contact Persons as described in Objective 3.

Table I-1. Definition of Estimated Incumbent Population, Sample and Number of Respondents Stratified by SIC

	Industrial Hygiene		
Industry Classification (SIC)	Estimated Population Size	Needed Sample Size	Number of Respondents
Mining	24	14	14
Contract Construction	2	2	3
Manufacturing	451	96	160
Transportation, Communication, and Utilities	15	13	13
Finance, Insurance, and Real Estate	82	26	27
Services	59	29	47
Total	633	180	264

	Safety Professional		
Industry Classification (SIC)	Estimated Population Size	Needed Sample Size	Number of Respondents
Mining	87	19	45
Contract Construction	347	12	38
Manufacturing	3076	176	278
Transportation, Communication, and Utilities	477	53	64
Finance, Insurance, and Real Estate	--	64	105
Services	370	36	53
Total	4377	360	583

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CHAPTER II

ANALYSIS OF EXPERT PRACTITIONER DATA

Objective II.

To determine the knowledge and skill requirements for the Industrial Hygiene and the Safety Professional occupations as defined by a select group of practitioner experts as "optimum task requirements."

Five (5) tasks were required to be performed in this Objective:

(1) Select an Advisory Group of Expert Consultants,

(2) Select Expert Practitioners,

(3) Develop a Task/Activity Analysis Survey Form and secure approval of the Form from the Advisory Group of Expert Consultants,

(4) Secure approval of the Form from the Sponsor, and

(5) Obtain Expert Practitioner's Input through use of the Task/Activity Analysis Survey Form.

(1) Select an Advisory Group of Expert Consultants

For a project of this magnitude, it was considered very desirable to secure the guidance of an Advisory Group of Expert Consultants. Accordingly, twenty (20) outstanding professionals actively engaged in occupational safety and health were selected and invited to serve on this advisory group. They were chosen for their detailed knowledge in some specific aspect of occupational safety and health (noise control, toxicology, occupational medicine, engineering, etc.) as well as their broad experience in Industrial Hygiene and Safety Engineering. Sixteen (16) of the selected individuals agreed to serve on the Advisory Group of Expert Practitioners. They are identified in the Project Advisory Committee listed earlier in this final report. The primary function of the Advisory Group of Expert Consultants was to guide the project in the development of a task/activity survey form and to assist in the final assignment of tasks/activities to academic levels.

(2) Select Expert Practitioners

Two groups of Expert Practitioners were selected, one for the *Industrial Hygiene* category and one for the *Safety Professional* category. Twenty (20) individuals were originally selected for each category; fifteen (15) Industrial Hygienists and fifteen (15) Safety Professionals agreed to serve as Expert Practitioners. These individuals are identified earlier in this final report. Their prime responsibility was to determine "optimum task requirements", i.e., the knowledge and skill requirements of the occupations included in the two categories. Their responsibilities included determining the tasks/activities to be completed by individuals certified by the American Board of Industrial Hygiene or the Board of Certified Safety Professionals, individuals who were in training to become certified as an Industrial Hygienists or as a Safety Professional by the respective Boards, and individuals performing at the technician level. Another task of the Expert Practitioners was to assist in determining the knowledge requirements for performing the tasks/activities. The Expert Practitioners answered the question, "What is the optimum occupational level at which the task/activity should be performed and what is the required knowledge?"

(3) Develop a Task/Activity Analysis Survey Form

Three generations of task/activity survey forms were developed. The initial survey form developed by the project staff gave specific attention to the (1) recognition, (2) evaluation and (3) control groups of tasks/activities. Preliminary testing of this survey form indicated that individuals tended to respond with the "expected" answer, e.g., they did "recognize" the exposures listed in the section of the survey designation as "recognition of exposures". Hence, the form was modified to list the tasks/activities randomly and without any pre-conceived designation of the type of tasks/ activities a respondent might be considering. This resulted in a sixty-one (61) page format with 1,026 individual task/activity responses required plus the responses required for background data. The task/activity survey form was submitted to the Advisory Group of Expert Consultants for review prior to a conference meeting. Following the reviews and the conference meeting, and acting on the advice of the Advisory Group of Expert Consultants, the task/activity survey form was reduced to a total of 753 tasks/activities, including those requiring multiple answers. Thus, this became the Task/Activity Analysis Survey Form and was used to gather data from both the Expert Practitioners and from the Incumbents.

(4) Secure Approval of the Task/Activity Analysis Survey Form

After final approval of the survey form by the Advisory Group of Expert Consultants, the form was submitted to the Sponsor for approval. Subsequently, approval was granted and the first phase of data collection was initiated.

(5) Obtain Expert Practitioners Input Through Use of the Task/Activity Analysis Survey Form

As part of this project's primary purpose of acquiring data concerning the knowledge and skills required of Industrial Hygienists and Safety Professionals so that job-related curricula could be developed for those occupations, the select panel of Expert Practitioners was established. These experts participated by giving opinion responses as to the "optimum level" at which each of a list of 753 tasks/activities should be performed within each occupational category. They also participated by giving opinion responses as to the necessary prerequisite knowledge (i.e., education and training) required for each task/activity. Their responses represented the best available data for determining the "optimum task requirements" for *Industrial Hygiene* and *Safety Professional* occupational levels and would be used subsequently in comparison with responses made by a large sample of incumbents. These subsequent comparisons formed the basis for evolving curricula designed to incorporate both the "optimum task requirements" with the current incumbent requirements in preparing individuals to enter at various levels of employment in occupational safety and health.

The responses made by the Expert Practitioners were used to answer the following questions regarding the 753 tasks/activities listed on the survey form:

1. Should a task/activity be performed?
2. If the task/activity should be performed, at what level(s) should it be performed?
3. Was there any difference between the level(s) of performance assigned by the *Industrial Hygiene* Experts and the level(s) of performance assigned by the *Safety Professional* Experts?
4. Was there any relationship between the assignment of occupational level and function classification for the list of tasks/activities?

5. Was there any relationship between the opinions of prerequisite knowledge requirements made by the *Industrial Hygiene* Experts and the opinions of prerequisite knowledge requirements made by the *Safety Professional* Experts?

PROCEDURES

The panel of thirty (30) Expert Practitioners was composed of fifteen (15) *Industrial Hygienists* and fifteen (15) *Safety Professionals*. The members of the panel, collectively, represented a broad spectrum of industrial experience and background and, individually, were highly qualified in their chosen profession. Fifteen (15) members functioned in administrative positions; nine represented the academic community (six of the nine had extensive professional experience before entering academia). The mean years of experience for the panel members was 26.5 years; the minimum years of experience of a panel member was 7 years. Thus, all the members of the panel had sufficient experience to have encountered most of the problems prevalent within the occupational safety and health field.

In terms of educational background, approximately half of the members had a graduate degree (six holding a doctoral degree) and half had a baccalaureate degree. The predominant discipline was engineering at the undergraduate level and industrial hygiene and engineering at the graduate level.

Twelve (12) of the *Industrial Hygienists* were certified by the American Board of Industrial Hygiene, twenty-two (22) of the panel were certified by the Board of Certified Safety Professionals, one (1) member was a physician, and fourteen (14) members were Registered Professional Engineers.

A detailed summary of the background of the Expert Practitioners is presented earlier in this final report.

The panel of Expert Practitioners was given two opportunities for expressing opinions relative to the tasks/activities listed on the Task/Activity Analysis Survey Form. The survey form and instructions used are presented in Appendix II . The initial opportunity consisted of completing, independently, the survey form and the Personal Background Data Form which were mailed, along with the guidelines and instructions, to each Expert Practitioner. The completed forms were then returned, by mail, to the project staff. The data collected from the initial responses were accumulated and tabulated in a subsequent report Preliminary Data for Technical Report III. The second opportunity for expressing their opinions occurred at a meeting in which the Expert Practitioners had group discussions prior to making their second individual decision on task/activity assignment levels. During the group discussions, it was emphasized that the occupational level should be assigned on the basis of entry level competencies (i.e., if the task/activity could be performed at the In Training level rather than the Professional level, the task/activity should be assigned to the In Training level). The panel of experts also provided opinions relative to the preferred education and training requirements for each task/activity during this meeting. Because of schedule conflicts it was not possible for all of the experts to meet at one time and at one location. Therefore, three meetings were held: one at College Station, Texas; one at Cincinnati, Ohio; and one at Dallas, Texas. At each of these meetings the individuals, in three-man or four-man subgroups composed of both *Industrial Hygienists* and *Safety Professionals*, were directed to:

1. Complete a task/activity survey form for their respective occupational category using the following guidelines:
    a. hold a subgroup discussion of every third task/activity on the survey form as designated by the Project Staff,

b. independently assign the prerequisite knowledge and the related knowledge considered to be necessary for the performance of each task/activity, and

2. make individual and independent assignments of the level at which each task/activity should be performed.

In performing assignment 1.(b), above, the Expert Practitioners selected one of the four academic levels (High School, Associate, Baccalaureate, or Graduate) in making their education/training assignment for each task/activity. These academic levels are defined in Table II-1. The prerequisite knowledge selections were made from a list composed of Biological Sciences, Engineering Sciences, Industrial Engineering, Industrial Hygiene, Liberal Arts, Management Sciences, Mathematical Sciences, Mechanical Arts, Physical Sciences and Safety Engineering. Definitions for the prerequisite knowledge are provided in Table II-2. The Expert Practitioners were instructed to carefully consider the content implied in the prerequisite knowledge subject matter categories when making their assignments and not think of the titles, such as Mathematical Sciences, as titles of courses.

Thus, each task/activity was studied by the Expert Practitioners, was designated by a performance level (0 - not performed at any level, 1 - performed by Technicians, 2 - performed by those In Training, 3 - performed by Professionals, and 4 - performed by Administrators), and was designated as to the preferred academic level and prerequisite knowledge preparation.

RESULTS

In the statistical analysis of the initial data provided by the Expert Practitioners, the following questions guided the analysis:

1. Was a task/activity designated as "performed" or "not performed" by the *Industrial Hygienist*?

Table II-1. Definitions of Academic Levels Utilized by Expert Practitioners in Making Assignments

Academic Levels	Definitions
High School	Minimum introduction to subject areas with limited inference to application of the subject matter--high school diploma or equivalent.
Associate	An introduction to the subject area with emphasis on application of specific skills and knowledge in limited areas; usually a terminal two year degree program.
Baccalaureate	Study of the subject material with introduction to the theories and principles involved with specialized application of the theories and principles--four year degree program.
Graduate	Study of the subject material with sufficient understanding of principles to be used; a thorough theoretical and practical familiarization with and expertise in the practice of the subject material--post baccalaureate study.

Table II-2. Definitions of Prerequisite Knowledge as Utilized by Expert Practitioners in Making Assignments

Prerequisite Knowledge	Definitions
Biological Sciences	Zoology, Microbiology, Physiology, Pharmacology, Toxicology, Immunology, Epidemiology, Biology
Engineering Sciences (Omitted from High School designation)	Fluid Dynamics, Thermodynamics, Strength of Materials, Statistics, Dynamics, Waste Treatment, Structures, Soil Mechanics, Hydraulics, Electrical Circuits, Servo-Mechanics, Semi-Conductors, Power Systems, Machinery, Unit Operations
Industrial Engineering (Omitted from High School designation)	Operations Research, Plant Layout, Quality Control, Time and Motion Studies, Production Methods, Ergonomics, Computer Science
Industrial Hygiene (Omitted from High School designation)	Acoustics and Noise Control, Ventilation--Local and General, Instrumentation, Aerosol Technology, Health Hazard Recognition, Respiratory Protection, Health Hazard Evaluation
Liberal Arts	Composition and Rhetoric, Technical Writing, Public Speaking, Teaching/Training, Communications
Management Sciences	Management, Finance, Accounting, Economics, Marketing, Law, Insurance, Labor Relations
Mathematical Sciences	Algebra, Trigonometry, Analytical Geometry, Calculus, Differential Equations, Statistics
Mechanical Arts	Woodworking, Metalworking, Drafting, Plastics
Physical Sciences	Sound and Wave Motion, Light, Electricity and Electron Physics, Mechanics, Nuclear Physics, Heat, Meteorology, Mineralogy, Inorganic Chemistry, Organic Chemistry, Biochemistry, Physical Chemistry
Safety Engineering (Omitted from High School designation)	Mechanical Safeguarding, Systems Safety, Product Safety, Construction Safety, Flame Propagation, Extinguishing Systems, Fire Protection/Prevention, Materials Handling

2. Was a task/activity designated as "performed" or "not performed" by the *Safety Professional?*
3. Given that the Experts' responses indicate that both the *Industrial Hygienist* and *Safety Professional* groups "perform" the task/activity, was there any statistically significant difference between the frequency distribution of the four "performed" levels (1, 2, 3, and 4) assigned by the *Industrial Hygienists* and the corresponding frequency distribution assigned by the *Safety Professionals?*
4. Given that there was no statistically significant difference between the frequency distributions of the four "performed" levels as assigned by the two groups, was there any statistically significant difference in the frequency of the four "performed" levels?
5. At what level (1, 2, 3, or 4) or combined levels (1-2, 1-2-3, 2-3, 3-4, etc.) was the task/activity ultimately assigned?

The five performance levels (0) - not performed at any level, (1) - performed at Technician level, (2) - performed at In Training level, (3) - performed at Professional level, and (4) - performed at Administrator level to which the Expert Practitioners could assign each task/activity was constituted as an ordinal scale. The nature of this scale dictates that a non-parametric statistical analysis be used in determining the level of performance for each task/activity.

The procedures used to determine the level of performance for each task/activity is illustrated in the following steps.

Step 1.

The Binomial Test was used on each task/activity to determine if there was any significant difference between the frequency of Industrial Hygienists' responses indicating the task/activity was "performed" and the frequency indicating it was "not performed". The null hypothesis was that there was no significant difference between the "performed" and the "not performed" responses; the alternative hypothesis was that the frequency of the "performed" levels was greater than the frequency of the "not performed" level. The significance level (α) selected was 0.10.

Step 2.

The Binomial Test was used in the same manner as Step 1 on the Safety Professionals' responses to each task/activity.

To illustrate Steps 1 and 2, the response for task/activity number 7, "Make recommendations concerning specifications and plans for renovations and new construction," will be analyzed. The Industrial Hygiene Practitioner Experts responded to "the lowest level at which this task/activity should be performed by Industrial Hygiene personnel." The distribution of the fifteen Industrial Hygiene Practitioner Experts' responses is recorded in Table II-3.

Table II-3. Response of Industrial Hygiene Experts on Task/Activity Number 7
"Make recommendations concerning specifications and plans for renovations and new construction"

	Not Performed	Performed by Technicians	Performed by In Training	Performed by Professionals	Performed by Administrators
Performance Levels	(0)	(1)	(2)	(3)	(4)
Frequency of Response	2	0	3	10	0

The Safety Professional Practitioner Experts responded to "the lowest level at which this task/activity should be performed by Safety Professional personnel." The distribution of the responses of the fifteen Safety Professional Experts is provided in Table II-4.

Table II-4. Response of Safety Professional Experts on Task/Activity Number 7

"Make recommendations concerning specifications and plans for renovations and new construction"

	Not Performed	Performed by Technicians	Performed by In Training	Performed by Professionals	Performed by Administrators
Performance Levels	(0)	(1)	(2)	(3)	(4)
Frequency of Response	0	0	2	13	0

In answering the questions relative to the performance of this task/activity, the data were divided into "not performed" and "performed" categories. Tables II-5 and 6 provide the response of the Industrial Hygiene and Safety Professional Experts, respectively.

Table II-5. Industrial Hygiene Expert Response

	Not Performed	Performed
Performance Levels	(0)	(1, 2, 3 and 4)
Frequency of Response	2	13

Table II-6. Safety Professional Expert Response

	Not Performed	Performed
Performance Levels	(0)	(1, 2, 3 and 4)
Frequency of Response	0	15

Accordingly, as specified in Step 1, the Industrial Hygiene Expert data in Table II-5 was submitted to the Binomial Test under the null hypothesis, H_0, "there is no significant difference between the frequency of the performed and not performed responses." The one-tailed probability under H_0 is .004 which is less than $\alpha = .10$. Therefore, H_0 is rejected and the alternative is accepted; the frequency of responses of the Industrial Hygiene Experts for the "performed" levels was significantly greater than their frequency of responses for the "not performed" level.

Accordingly, the responses of the Safety Professional Experts in Table II-6 were tested; H_0 was rejected; the decision was that the task/activity is performed by Safety Professional personnel.

Step 3.

If both the *Industrial Hygiene* and *Safety Professional* groups performed the task/activity as determined by Steps 1 and 2, the Kolmogorov-Smirnov Two-Sample Test was used to determine if there was any difference between the frequency distribution of the four "performed" levels assigned by the Industrial Hygienists and the frequency distribution assigned by the Safety Professionals. The null hypothesis was that the frequency distributions of the two groups were not different; the alternative hypothesis was that the frequency distributions of the two groups were different. The significance level (α) was 0.05.

Since it was determined that both the Industrial Hygienist and the Safety Professional groups performed task/activity number 7, Step 3 is applicable. The Kolmogorov-Smirnov Two-Sample Test is concerned with the agreement between two sets of sample values, e.g., the agreement between the frequency of responses (by levels) of the Industrial Hygiene Experts and the frequency of responses (by levels) of the Safety Professional Experts, as calculated in Table II-7.

From a table giving the critical values of K_D in the Kolmogorov-Smirnov Two-Sample Test, it is noted that for N = 13, K_D would have to be equal to seven or greater for H_0 to be rejected. Therefore, it is concluded that the frequency distributions of the two groups are not significantly different and may, therefore, be combined.

Table II-7. Summary of the Kolmogorov-Smirnov Two-Sample Test of Task/Activity Number 7

Task/Activity Performance Levels	(1)	(2)	(3)	(4)
Frequency of Response (Industrial Hygiene Experts)	0	3	10	0
Frequency of Response (Safety Professional Experts)	0	2	13	0
(A) Cumulative Frequency Percent (Industrial Hygiene Experts)	0.000	0.231	1.000	1.000
(B) Cumulative Frequency Percent (Safety Professional Experts)	0.000	0.133	1.000	1.000
(A - B)	0.000	0.098	0.000	0.000

D = maximum $|A - B|$ = 0.098

K_D = 1.3 = largest difference (D) times number of responses (N) in smaller group (i.e., 0.098 x 13)

Step 4.

If from Step 3, it was determined that there was no significant difference between the frequency distributions of the Industrial Hygiene and Safety Professional groups, their distributions were combined. The combined distribution was then tested with the Kolmogorov-Smirnov One-Sample Test to determine if there was any difference among the frequencies of the four task/activity performance levels. The null hypothesis was that the frequency of each level was equal to the frequency of every other level; the alternative hypothesis was that the frequencies of responses to each level were not all equal. The significance level (α) was 0.20.

Table II-8. Summary of the Kolmogorov-Smirnov One-Sample Test of Task/Activity Number 7

Task/Activity Performance Level	(1)	(2)	(3)	(4)
f = Frequency of Responses (Industrial Hygiene plus Safety Professional Experts)	0	5	23	0
$F_0(X)$ = Theoretical Cumulative Percent Distribution of Choices Under H_0	0.250	0.500	0.750	1.000
$S_{28}(X)$ = Cumulative Percent Distribution of Observed Choices	0.000	0.179	1.000	1.000
$\lvert F_0(X) - S_{28}(X)\rvert$	0.250	0.321	0.250	0.000
D = maximum $\lvert F_0(X) - S_{28}(X)\rvert$ = 0.321				

The D-value of 0.321 derived in the analysis of responses to Task/Activity Number 7 in Table II-8 represents a significance level of less than 0.01. Therefore, the null hypothesis was rejected; the frequencies of responses to each level were not equal.

The Kolmogorov-Smirnov One-Sample Test was also used if, from Step 1 or Step 2, it was determined that only one group (either the Industrial Hygiene or the Safety Professional group) performed the task/activity. In this case, the distribution of responses of the group which performed the task was tested with the Kolmogorov-Smirnov One Sample Test, using Step 4 described above. When the analysis from Step 1 and Step 2 indicated the task/activity was "performed" by both groups, and the analysis from Step 3 indicated there was a significant difference in the two frequency distributions, then the distributions were not combined. In this case, the individual response distributions of the Safety Professional and Industrial Hygienists were separately analysed using the Kolmogorov-Smirnov One-Sample Test.

Step 5.

If the null hypothesis stated in Step 4 (i.e., the frequency of each level was equal to the frequency of every other level) was not rejected the task/activity was recorded as "performed" but at no specific level (that is, no preferred level of performance). If the null hypothesis was rejected (as illustrated with the use of Task/Activity Number 7 data in Step 4), the Binomial Test was then used to determine significant differences between specific task/activity performance levels. At this point, the task/activity could be indicated as performed at a single performance level (e.g., Professional) or levels could be combined (e.g., In Training and Professional) to produce significant differences from the remaining levels. If more than one combination of performance levels produced significant differences (e.g., Technician and In Training and In Training and Professional) the lower combination (i.e., Technician and In Training) was assigned to the task/activity.

The performance level assigned by the Expert Practitioners for each task/activity can be found in Appendix III, Technical Report III, and was made on the basis of the statistical treatment outlined above.

To determine if there was any difference in task/activity level assignments between the initial and second responses of the Expert Practitioners, a Chi-Square Test for two independent samples was performed on 45 randomly selected tasks/activities from the first 291 tasks/activities listed on the survey form. The null hypothesis was that the initial and second responses were equal and the alternate hypothesis was that the initial response was not equal to the second response.

Table II-9 shows the frequency of the initial and second responses for the 45 randomly selected tasks/activites. Based on the Chi-Square Test, the alternate hypothesis was accepted; i.e., there was a statistically significant difference between the initial and second responses of the Experts. However, it was noted that the primary cause of this difference was the change in the number of tasks/activities assigned as "not performed," i.e., there were 43 initial responses assigned as "not performed," while only 6 were assigned as "not performed" in the second response. It can be seen from Table II-9 that most of these tasks were assigned in the second response to the "In Training" (2) and "Professional" (3) levels. Of the initial responses, 77 were assigned to the "In Training" (2) level, while of the second responses, 90 were assigned to the "In Training" (2) level. Likewise, 88 initial responses were

Table II-9. Frequency of Task/Activity Performance Levels on Initial and Second Responses

Task/Activity Level Assignment		Second Response					
		0	1	2	3	4	TOTAL
Initial Response	0	2	8	9	22	2	43
	1	3	45	11	11	0	70
	2	1	13	39	23	1	77
	3	0	6	31	47	4	88
	4	0	0	0	4	3	7
	TOTAL	6	72	90	107	10	285

	0	1	2	3	4	TOTAL
Initial Response	43	70	77	88	7	285
Second Response	6	72	90	107	10	285
TOTAL	49	142	167	195	17	570

$$\text{Chi-Square} = \frac{(43 - 24.5)^2}{24.5} + \frac{(70 - 71)^2}{71} + \frac{(77 - 83.5)^2}{83.5}$$

$$+ \ . \ . \ . + \frac{(10 - 8.5)^2}{8.5} = 18.46$$

assigned to the "Professional" (3) level, while 107 second responses were assigned to the "Professional" (3) level. Therefore, the decision was made to accept the initial task/activity performance level assignments as presented in Technical Report III because of the high frequency of "performed" versus "not performed" tasks/activities previously determined. That is, the differences between the initial and second responses did not likely change a task/activity assignment from "not performed" to "performed," but only changed some of the votes from "not performed" to "performed" on a task/activity that was already assigned as "performed."

The relationship of task/activity level assignments and task/activity function classifications was also evaluated. The task/activity level assignments were determined by the statistical procedures previously described. The Project Staff developed the four function classifications for *Industrial Hygienists* and *Safety Professionals* after careful consideration of materials developed and published by the American Industrial Hygiene Association (AIHA) and the American Society of Safety Engineers (ASSE).

The AIHA published information on the scope and function of the Industrial Hygienist in their publication "Industrial Hygiene - Definition, Scope, Function, and Organization" in which it was indicated that Industrial Hygiene primarily involves:

"(1) the recognition of environmental factors and stress associated with work and work operations, and the understanding of their effects on man and his well being in the work place and the community;

(2) the evaluation, through training and experience, and with the aid of quantitative measurement techniques, of the magnitude

of these factors and stresses in terms of ability to impair men's health and well being; and

(3) the prescription of methods to control or reduce such factors and stresses when necessary to alleviate their effects."

In 1966, the ASSE adopted and published "Scope and Function of the Professional Safety Position" in which the major functions described were:

"(1) Identification and appraisal of accident and loss-producing conditions and practices and evaluation of the severity of the accident problem.

(2) Development of accident prevention and loss-control methods, procedures and programs.

(3) Communication of accident and loss-control information to those involved directly.

(4) Measurement and evaluation of the effectiveness of the accident and loss-control system and the modifications needed to achieve optimum results."

The functions, defined as function classifications, developed by the Project Staff are composites of those developed by the AIHA and the ASSE. McCormick indicates that "functions are generally spelled out in terms of the combinations of tasks/activities that form jobs that are to be performed." He further indicates that tasks/activities to be performed can be grouped by types of training objectives. Types of training objectives include knowledge of principles and relationships; identifying or recognizing objects, locations, agents, etc.; following defined procedures; performing skilled preceptual-motor acts and making decisions and choosing courses of action. Therefore, and with training/education objectives as a guiding principle, the four functions utilized in classifying tasks/activities were described as:

CLASS A. RECOGNITION/IDENTIFICATION OF EXPOSURES

The recognition of or the identification of exposures in the workplace that may adversely affect the health and well-being of the system, the maintenance of homeostasis or the ability of the system or sub-systems to accomplish their planned mission. Exposures include chemical, electrical, physical, mechanical, ergonomic, biological and environmental and psychophysiological stresses. System includes man, machine, environment or combinations of the man-machine-environment elements of the system or sub-systems.

CLASS B. ACQUISITION OF DATA/MEASUREMENT OF EXPOSURES

Acquisition of quantitative/qualitative measurements of exposures which may have a deleterious effect on the system or sub-systems.

CLASS C. ANALYSIS OF DATA/EVALUATION OF MEASUREMENT RESULTS

Prediction of probable effects of exposures on the health and well-being of the system, the maintenance of homeostasis, or the ability of the system or sub-system to accomplish their planned mission.

CLASS D. CONTROL OF EXPOSURES

Prescription of and/or design of optimum controls for both single and multiple level exposures that will affect the health and well-being of the system, the maintenance of homeostasis, or the ability of the system or sub-systems to accomplish their mission. Controls include management, medical, engineering, education/training, and personal protective equipment.

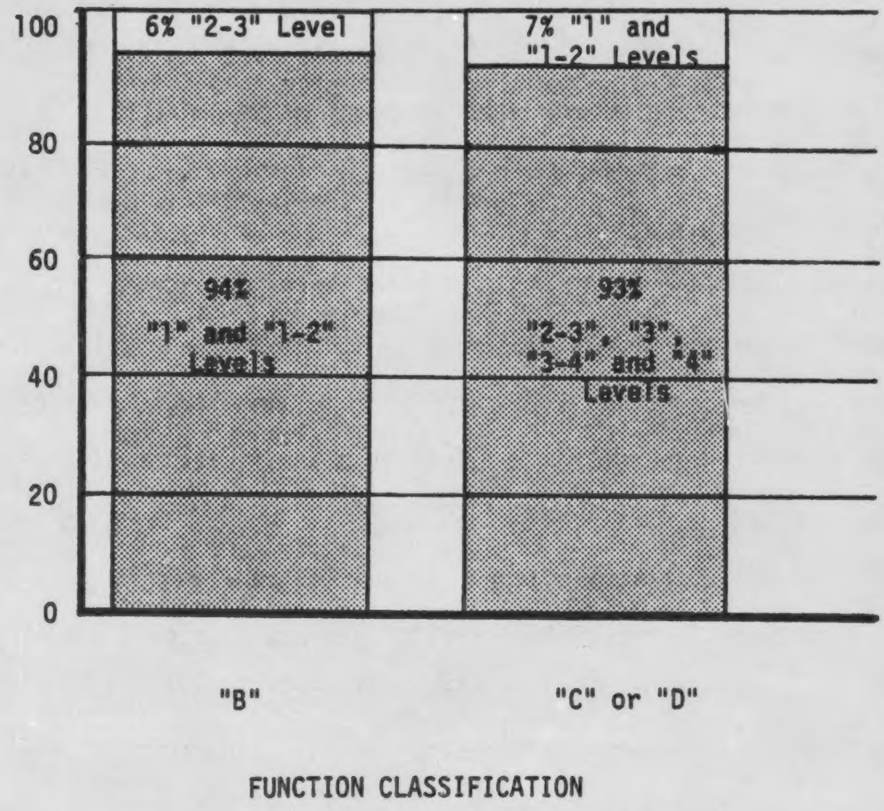
Within this research, the emphasis is on "behavioral objectives", e.g., performance objectives that describe what an individual will be doing when demonstrating that he has achieved an objective. Thus, the tasks/activities associated with acquiring exposure data, analyzing the data, and developing controls for the exposures represent functional behavior objectives.

It is also recognized that there are some tasks/activities that may be, by design, closely aligned with didactics, e.g., more clearly aligned with knowing than doing. The tasks/activities of this type probably include the "recognition/identification of exposures" function which may be a cognitive experience primarily. Indeed, study of the task/activity survey form reveals that only a few tasks/activities could be classed, by definition, as a recognition function. Task/activity number 292, "Conduct walk through inspections to identify potential hazards", was identified as a recognition function, Class A. This task/activity suggests a non-instrumented observation of operations that may result in recognition of exposures that are potentially hazardous, e.g., operation of several fork trucks powered by internal combustion engines in a closed warehouse with a possible exposure to carbon monoxide.

Figure II-1, shows the relationship between the task/activity function classifications and task/activity level assignments for the first 291 tasks/activities of the survey form. Of the 291 tasks/activities sampled, 94 percent (100/106) of the Class B tasks/activities, ACQUISITION OF DATA/MEASUREMENT OF EXPOSURE, were assigned to the "1" (Technician) and "1-2" (Technician and In Training) levels. Similarly, 93 percent (101/109) of the Class C tasks/activities, ANALYSIS OF DATA/EVALUATION OF MEASUREMENT RESULTS or Class D, CONTROL OF EXPOSURES, were assigned to the "2-3" (In Training and Professional) or higher levels.

One of the functions of the panel of Experts was "to determine and assign independently the (a) Prerequisite Knowledge and the (b) Related Knowledge considered to be necessary for an individual to perform the task/activity."

Figure II-1. Relationship Between the Task/Activity Function Classifications and Task/Activity Level Assignments for Tasks/Activities 1 through 291.



The decisions to be made by the Experts involved four academic levels (as previously defined in Table II-1):

1 - High School Level
2 - Associate Degree Level
3 - Baccalaureate Degree Level
4 - Graduate Degree Level.

In addition, ten Prerequisite Knowledge academic subject matter categories were to be utilized (Biological Sciences, Engineering Sciences, Industrial Engineering, Industrial Hygiene, Liberal Arts, Management Sciences, Mathematical Sciences, Mechanical Arts, Physical Sciences, and Safety Engineering as previously defined in Table II-2). Four of the academic subject matter categories were omitted from the high school designation; Engineering Sciences, Industrial Engineering, Industrial Hygiene, and Safety Engineering. This permitted the opportunity for 36 distinct classifications of academic level/ subject matter.

A detailed summary of the prerequisite knowledge data is presented in Appendix IV of Technical Report III. The analysis of the data consisted of rank ordering the 36 Prerequisite Knowledge categories for the task/activity level assignments and function assignments indicated from Table II-10. In the ranking, the highest frequency of response was given the rank of 1 and the lowest frequency of response was given the rank of 36. Tied frequencies were assigned an average of the corresponding ranks.

A Spearman Rank Correlation Analysis was performed to determine the relationship between the Prerequisite Knowledge specified by the Industrial Hygiene group and the Prerequisite Knowledge specified by the Safety Professtional group. Table II-10 shows the values of Spearman Rank Correlation Coefficients (r_s) for seven comparisons by task/activity level assignments.

Table II-10. Correlation (Spearman Rank, r_s) of Prerequisite Knowledge Responses of Safety Professionals with those of Industrial Hygienists by Task/Activity Level and Task/Activity Function Assignments

INDUSTRIAL HYGIENE	SAFETY PROFESSIONAL 1	1-2	2-3	3, 3-4, 4	B	C	D
1	.921						
1-2		.933					
2-3			.952				
3, 3-4, 4				.905			
B					.948		
C						.902	
D							.936

Task/Activity Level Assignments

1 - Technician
1-2 - Technician/In Training
2-3 - In Training/Professional
3, 3-4, 4 - Professional/Professional-Administrator/Administrator

Task/Activity Function Assignments

B - Acquisition of Data/Measurement of Exposure
C - Analysis of Data/Evaluation of Measurement Results
D - Control of Exposures

The high correlation between the two groups over all the task/activity level assignments and the task/activity function assignments indicates that both groups agreed almost completely on the relative importance of the Prerequisite Knowledge categories.

It is observed that there is a high correlation (r_s = .922) for the Technician level tasks/activities (1) and the tasks/activities assigned to the Technician/In Training levels (1-2). This suggests that the Prerequisite Knowledge required for these two groups is the same. In addition, the Prerequisite Knowledge required for In Training/Professional level tasks/activities (2-3) shares a very high correlation (r_s = .945) with the Professional/Professional-Administrator/Administrator (3, 3-4, 4) level tasks/activities. Likewise, there is a high correlation (r_s = .973) between the Prerequisite Knowledge required for Analysis of Data/Evaluation of Measurement Results and Control of Exposures. The Prerequisite Knowledge required for the In Training/Professional (2-3) and the Professional/Professional-Administrator/Administrator (3, 3-4, 4) tasks/activities is different from that required for the Technician (1) tasks/activities since their correlation coefficients are not statistically different from zero (r_s = .392 and .295 respectively, i.e., no correlation). The data in Table II-11 also confirms the results shown in Figure II-1,that is, the high correlation between the "1", "1-2", and "B" task classifications, as well as between the "2-3", "3", "3-4", "4", "C" and "D" task classifications.

Table II-12 presents the rankings of the fifteen predominant academic subject matter categories (Prerequisite Knowledge categories) by Task/Activity Performance Level Assignment and Task/Activity Function Assignment. From Table II-12 the relative rank of specific Prerequisite Knowledge categories can be observed and comparisons made between the task/activity

Table II-11. Intercorrelations (Spearman Rank, r_s) of Prerequisite Knowledge Responses for Task/Activity Level and Task/Activity Function Assignments From the Combined Safety Professional and Industrial Hygiene Groups

TASK/ACTIVITY LEVELS AND FUNCTIONS

		1	1-2	2-3	3, 3-4, 4	B	C	D
TASK/ACTIVITY LEVELS AND FUNCTIONS	1	--						
	1-2	.922	--					
	2-3	.392	.538	--				
	3, 3-4, 4	.295	.400	.945	--			
	B	.941	.979	.569	.459	--		
	C	.356	.477	.977	.960	.534	--	
	D	.344	.488	.969	.987	.503	.973	--

NOTE: Any value of r_s less than 0.424 is not significantly different from zero (i.e., no correlation) at the 0.01 significance level.

Task/Activity Level Assignments

1 - Technician
1-2 - Technician/In-Training
2-3 - In-Training/Professional
3, 3-4, 4 - Professional/Professional-Administrator/Administrator

Task/Activity Function Assignments

B - Acquisition of Data/Measurement o Exposure
C - Analysis of Data/Evaluation of
D - Control of Exposures

Table II-12. Ranking of Top 15 Academic Subject Matter Categories by Task/Activity Performance Level Assignment and Task/Activity Function for the Safety Professional and Industrial Hygienists Groups Combined

LEGEND A
TASK/ACTIVITY PERFORMANCE LEVEL ASSIGNMENT

"1" - Performed by Technician classification
"1-2" Performed by Technicians and In-Training classifications
"2-3" Performed by In-Training and Professional classifications
"3,3-4,4" - Performed by Professional and Administrator classifications

LEGEND B
TASK/ACTIVITY FUNCTION ASSIGNMENT

"B" - Acquisition of data/measurement or exposures
"C" - Analysis of data/evaluation of measurement results
"D" - Control of exposures

LEGEND C
ACADEMIC SUBJECT MATTER LEVELS

* - High School
** - Associate
*** - Baccalaureate
**** - Graduate

	Task/Activity Performance Level Assignment				Task/Activity Function Assignment			
Rank	"1"	"1-2"	"2-3"	"3, 3-4, 4"	"B"	"C"	"D"	Rank
1	Industrial Hygiene **	Industrial Hygiene **	Safety Engineering *** and	Safety Engineering ***	Industrial Hygiene **	Safety Engineering ***	Safety Engineering ***	1
2	Physical Sciences **	Safety Engineering **	Industrial Engineering ***	Industrial Engineering ***	Physical Sciences **	Industrial Engineering ***	Industrial Engineering ***	2
3	Safety Engineering **	Physical Sciences ** and	Industrial Hygiene ***	Engineering Sciences ***	Safety Engineering **	Physical Sciences ***	Engineering Sciences ***	3
4	Biological Sciences **	Biological Sciences **	Physical Sciences ***	Physical Sciences ***	Biological Sciences **	Engineering Sciences ***	Physical Sciences ***	4
5	Mathematical Sciences **	Mathematical Sciences **	Biological Sciences ***	Management Sciences ***	Mathematical Sciences **	Mathematical Sciences ***	Industrial Hygiene ***	5
6	Engineering Sciences **	Liberal Arts **	Engineering Sciences ***	Industrial Hygiene ***	Engineering Sciences **	Industrial Hygiene ***	Management Sciences ***	6
7	Liberal Arts **	Engineering Sciences **	Mathematical Sciences ***	Mathematical Sciences ***	Liberal Arts ** and	Biological Sciences ***	Biological Sciences ***	7
8	Industrial Engineering **	Industrial Engineering **	Liberal Arts ***	Liberal Arts ***	Industrial Engineering ***	Management Sciences ***	Liberal Arts ***	8
9	Mechanical Arts **	Industrial Hygiene ***	Management Sciences ***	Biological Sciences ****	Mechanical Arts **	Liberal Arts *** and	Mathematical Sciences ***	9
10	Management Sciences **	Mechanical Arts **	Industrial Hygiene ****	Industrial Hygiene ****	Industrial Hygiene ****	Industrial Hygiene ****	Industrial Hygiene ****	10
11	Physical Sciences ***	Management Sciences ** and	Mechanical Arts ***	Mechanical Arts ***	Management Sciences **	Liberal Arts **	Mechanical Arts ***	11
12	Liberal Arts *	Safety Engineering ***	Liberal Arts **	Safety Engineering ****	Safety Engineering ***	Mechanical Arts ***	Safety Engineering ****	12
13	Industrial Hygiene ***	Physical Sciences ***	Industrial Hygiene **	Mechanical Arts **	Physical Sciences ***	Safety Engineering **** and	Mechanical Arts ** and	13
14	Safety Engineering ***	Liberal Arts *	Biological Sciences **	Liberal Arts **	Liberal Arts *	Biological Sciences **	Liberal Arts **	14
15	Mathematical Sciences *	Biological Sciences ***	Mechanical Arts **	Management Sciences ** and Biological Sciences **	Biological Sciences ***	Management Sciences **	Management Sciences ** and Biological Sciences **	15

classifications and both the Task/Activity Performance Level Assignments and the Task/Activity Function Assignments. In addition, comparisons can be made to the relative Academic Subject Matter Levels. For example, it is noted that the Task/Activity Performance Levels of Technician (1) and Technician/In Training (1-2) require Associate Level Prerequisite Knowledge (**). As would be expected, the Acquisition of Data/Measurement of Exposure (B) Task/Activity Function Assignment requirements are also predominantly Associate level (**). As indicated, the In Training/Professional (2-3), Professional/Professional-Administrator/Administrator (3, 3-4, 4) and Control of Exposures (D) task/activity assignments require Baccalaureate level Prerequisite Knowledge most often.

These results lead to the following conclusions:

1. The tasks/activities of the survey form are representative of the many tasks and activities performed by individuals employed within the two professions of *Industrial Hygiene* and *Safety Professional*.
2. The tasks/activities can be identified and assigned as "performed" or "not performed" and the "performed" tasks/activities can be assigned to various levels of performance within the two professions; Technician, In Training, Professional, and Administrator.
3. The four levels of performance are not as precise as often considered when task/activity assignments are governing criteria. However, levels of performance by task/activity criteria can be more completely described as (1) Technician, (2) Technician/In Training, (3) In Training/Professional, (4) Professional, (5) Professional/Administrator, and (6) Administrator.
4. Within the two professions, there is considerable agreement on the task/activity level assignments.

5. The tasks/activities on which there is Expert Practitioner agreement and disagreement in level assignment can be identified.
6. Broad Prerequisite Knowledge requirements can be identified for each task/activity and the Prerequisite Knowledge can be assigned to academic subject matter categories by Task/Activity Performance Level Assignment and by Task/Activity Function Assignments.
7. General guidelines for curricula content can be determined based on Task/Activity Performance Level Assignments and Task/Activity Function Assignments.

DISCUSSION

As revealed in Technical Report III, Task Analyses for the Industrial Hygienists and the Safety Professional as Determined by a Group of Expert Practitioners, all tasks/activities 1 through 291 were indicated as performed at some level by either the Industrial Hygiene or the Safety Professional Experts. It is further revealed that there was agreement on level assignment between the two groups on 152 of the first 291 tasks/activities, or 52 percent. To clarify, and using task/activity number 7 as an example, the Industrial Hygiene Experts assigned this to the "performed" category as did the Safety Professional Experts. Of the 25 tasks/activities (from the first 291) assigned to the "professional" level, there was agreement on 20 of the tasks/activities, or 80 percent.

The data presented in Table II-12 could be utilized as general guidelines in developing curricula. If the curriculum objective is the preparation of individuals to perform "Acquisition of Data/Measurement of Exposures" (B) Task/Activity Functions, the first eight ranked academic subject matter categories may be sufficient. It is noted that these eight are Associate level categories (with one exception) and that there is a very high correlation with the first eight ranked academic subject matter categories listed under Technician (1) and Technician/In Training (1-2) Task/Activity Performance Level assignments. This would provide guidelines for an Associate level academic program as described by subject matter categories for individuals educated and trained to perform Technician and In Training tasks/activities.

For this example, the first eight ranked academic subject matter categories, as defined in Table II-2 are:

1 - INDUSTRIAL HYGIENE
2 - PHYSICAL SCIENCES
3 - SAFETY ENGINEERING
4 - BIOLOGICAL SCIENCES
5 - MATHEMATICAL SCIENCES
6 - ENGINEERING SCIENCES
7 - LIBERAL ARTS
8 - INDUSTRIAL ENGINEERING

Conversely, subject matter categories can be determined for the Task/Activity Functions characterized as Analysis of Data/Evaluation of Measurement Results (C) and Control of Exposures (D). It is evident that the tasks/activities assigned to these functions require Baccalaureate level education/training as a minimum. Since these tasks/activities are performed by In Training, Professional, and Administrator personnel, there is a very high correlation between the subject matter categories assigned to these and the subject matter categories assigned to Analysis of Data/Evaluation of Measurement Results (C) and Control of Exposures (D).

SUMMARY

A Task/Activity Analysis Survey Form for two health and safety categories, *Industrial Hygiene* and *Safety Professional*, was developed and administered to a select panel of 30 Expert Practitioners. The panel members were selected for their professional experience and expertise and were evenly divided between Safety Professionals and Industrial Hygiene Professionals.

These Expert Practitioners provided information on the occupational level, i.e., Technician, In Training, Professional, or Administrator, at which each of the 753 tasks/activities on the survey form should be performed. They also provided information on the academic preparation required for individuals to perform each task/activity. The data were accumulated and analyzed statistically to determine at what occupational levels within the *Industrial Hygiene* and *Safety Professional* categories each task/activity should be assigned. In addition, academic preparation data were analyzed to determine the Prerequisite Knowledge required for successful task/activity performance and the academic level (high school through graduate school) at which the instruction should be provided.

Analyses revealed very high correlations between assignments made to tasks/activities and functions as well as between the assignments made by the *Industrial Hygiene* and *Safety Professional* Experts.

There is evidence to support that tasks/activities within the professional areas of *Industrial Hygiene* and *Safety Professional* can be subdivided into four levels of performance; Technician, In Training, Professional, and Administrator. However, levels of performance can be more completely described by some combinations of these levels. While the two professionals may have different objectives, there is considerable agreement on task/activity level assignments, over-all and within the levels of performance. Furthermore, there is strong evidence to indicate a high level of similarity in academic preparation for performing the tasks/activities.

The determination of the knowledge and skill requirements for the Industrial Hygiene and the Safety Professional categories as defined by the Expert Practitioners is published in Task Analysis Outputs for the Industrial Hygienist and the Safety Professional as Determined by a Group of Expert Practitioners.

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CHAPTER III

ANALYSIS OF INCUMBENT DATA

Objective III.

To complete a task and activity analysis associated with occupational levels within the Industrial Hygiene and Safety Professional professions.

In order to determine what activity is currently being performed in the field of occupational safety and health, the task/activity survey form developed by the project staff and approved by the Advisory Group of Expert Consultants was mailed to Contact Persons who distributed them to occupational safety and health personnel employed in the categories of Industrial Hygiene and Safety Professional in their companies. The responses from the sampled Incumbents provided data on the frequency level at which each of the 753 tasks/activities were performed and also data regarding the Incumbent's personal and professional background. The results of this sample were then compared to the data collected from the Expert Practitioners to aid in the development of curricula for preparing individuals to enter at the various levels of employment in occupational safety and health. The incumbent data was analyzed to determine at what occupational level(s) within the two categories, *Industrial Hygiene* and *Safety Professional*, each task/activity is currently being performed.

PROCEDURES

The sampling procedure used in collecting the Incumbent data was patterned after the recommended procedure detailed in the report Feasibility Study Covering Nationwide Occupational Safety and Health Manpower Survey as previously described in Objective I. The Task/Activity Analysis Survey Form used to gather data from the Incumbents was identical to the form utilized by the Expert

Practitioners. However, the Expert Practitioners responded to (1) the optimum occupational level at which they believed a task/activity should be performed and (2) to the prerequisite knowledge required to perform the task/activity. The Incumbents were directed to respond to the frequency level at which they performed each task/activity and to provide background data (age, education, job responsibilities, etc.). The complete Task/Activity Analysis Survey Form, Appendix II , is identical to the form provided to each Incumbent.

As indicated above and as informed in the instructions accompanying each Task/Activity Analysis Survey Form, the Incumbents responded to the task/activity section of the survey form by indicating the frequency level with which they performed a task/activity. These responses were as follows:

1. Frequently - performed a minimum of five times annually.
2. Occasionally - performed at least once in the past two years.
3. Never - has not been performed in the past two years.

The task/activity listing itself was broken down into two separate parts. The first part indicated specific tasks which might be performed in a particular situation. In the second part of the listing, the tasks/activities were arranged by type of exposure. Each task/activity represented a function which may be performed by individuals in each occupational level in each of seven types of exposures. These types of exposures are:

1. Air quality -- harmful materials (gases, vapors, fumes, mists, dusts, and particulate matter) which are airborne health exposures.
2. Physical exposures -- noise, vibration, temperature, ionizing and non-ionizing radiation, and abnormal pressures.
3. Hazardous materials -- liquid and solid substances that have harmful effects on persons.

4. Flammable materials -- gases, vapors, dusts, liquids, and solids that result in fire and explosion.
5. Materials handling -- manual (lifting, pushing, pulling, stacking, etc.), mechanical (fork trucks, cranes, conveyors, elevators, etc.), and transportation systems and ergonomic exposures.
6. Mechanical and electrical -- point of operation, mechanical power transmission (belts, pulleys, etc.), electrical bonding and grounding, electrical shock, etc.
7. Facilities -- buildings, grounds, walking and working surfaces, utilities (water, gas, electric, steam, etc.).

The tasks/activities in this section were such that they might be performed by an individual respondent for any or all of the seven types of exposures. However, it was felt that certain of the tasks would only be performed for some of the seven types of exposures by a given occupational level. Thus, it was necessary to provide the respondent with the opportunity to indicate in which of the areas the task was performed.

A total of 357 separate tasks/activities was identified and included within the survey form. Since the last 66 tasks related to the seven different exposures, a total of 462 responses was necessary in this area. Thus, a total of 753 responses was required of each Incumbent.

As described in Chapter I, Contact Persons were identified from the rosters of professional organizations; subsequently, their employers were identified and classified by SIC codes. These SIC classifications were necessary to determine the population size, the sample size needed to represent the population, and the number of Incumbents for each occupational category. The Contact Persons also served the function of selecting Incumbents in their organization or company as requested by the project staff.

Contact Persons originally selected were contacted by telephone. The Contact Person was informed of the purpose of the project and the method of selecting his name and company. He/she was then given the opportunity to explain the occupational safety and health organization in his/her company, the number of occupational safety and health personnel, the executive who could approve participation by company personnel in the project, etc. With rare exceptions, the initial response was very positive. In approximately 60 percent of the telephone contacts, the originally selected Contact Person had the authority to approve company personnel responding to the request. In the remainder, the project staff was courteously referred to a company executive capable of granting permission for company personnel to participate in the survey. Therefore, when this occurred, the originally selected Contact Person lost his "identity" in that role and the company executive became the Contact Person of record. The newly designated Contact Person then indicated either a desire for his company personnel to participate or the opportunity was declined. If the election was to participate, the Contact Person and the Project Staff agreed on the number of survey forms to be sent to the Contact Person for distribution within his/her organization. The maximum number of Incumbents to respond from any single company was twenty-six (one of the major national corporations) and the minimum number was one. In this manner, 266 telephone contacts were made within companies through the randomly selected Contact Persons. The response of 213 of these companies was to participate in the project. A total of 1092 survey forms were mailed to the Contact Persons. These were distributed by the Contact Person in his company or the Contact

Person completed the survey form and returned it to the project staff (this could occur if the Contact Person was the only occupational safety and health person in his company). A total of 848 completed survey forms were returned to the project staff.

The initial action when the survey forms were received was to classify the forms based on the qualifications stated by each individual respondent. The classification system was based primarily on the experience, education, certification and responsibilities of the respondents. These classifications are defined below.

Industrial Hygiene (IH) Administrator - An individual holding certification for comprehensive practice or in one of the specialty aspects as described by the American Board of Industrial Hygiene and who manages two or more individuals, one of whom must be a Certified Industrial Hygienist.

Industrial Hygiene (IH) Professional - An individual certified for comprehensive practice or in one or more of the specialty aspects as described by the American Board of Industrial Hygiene.

Industrial Hygiene (IH) In Training - An individual meeting the academic and/or experience requirements for certification as an industrial hygienist but who has not achieved the certification as defined above. The majority of this individual's time must be spent in activity that would be acceptable to the American Board of Industrial Hygiene for certification purposes.

Industrial Hygiene (IH) Technician - An individual with at least two years education, training or the equivalent in the skills related to industrial hygiene/occupational health.

Safety Professional (SP) Administrator - An individual certified by the Board of Certified Safety Professionals and managing two or more individuals, one of whom must be a Certified Safety Professional.

Safety Professional (SP) Professional - An individual certified by the Board of Certified Safety Professionals.

Safety Professional (SP) In Training - An individual meeting the academic and/or experience requirements for certification as a safety professional but who has not achieved certification as defined above. This individual must spend a majority of his time in activity that would be acceptable to the Board of Certified Safety Professionals for certification purposes.

Safety Professional (SP) Technician - An individual with at least two years education, training, or the equivalent in the skills related to industrial safety/occupational safety.

The data gathered were reviewed and keypunched. A series of computer programs was developed to process the data and tabulate responses based upon various selection parameters. Data were computer edited to assure accuracy of response before further processing. Tabulation of the data by occupational level and category was performed indicating both the frequency of response in each of the three categories (i.e., frequently, occasionally, never), and the percentage of response at the selected level of those incumbents who indicated they performed the task. Results of a Task Analysis of Selected Occupational Safety and Health Professions: Industrial Hygiene and Safety Professional, Appendix III of Technical Report IV, gives the tabulation of the data received from the Incumbents. These data indicate the percentage of responses in each category (i.e., frequently, occasionally, never) for each of the selected occupational levels.

RESULTS

Summary of Incumbent Background Data-

The characteristics of the Incumbents in terms of the SIC in which they are working is indicated in Table III-1. In addition, the number of survey forms sent to contact persons and the number received from respondents is also indicated to illustrate the response pattern obtained.

From Table III-1, it is seen that a significant response was obtained in each of the SIC Classifications. Overall, 78 percent of the survey forms mailed were completed and returned. By far, the largest category of response was in the area of manufacturing in which 438 responses were obtained, or 51.6 percent of the total responses.

The totals given at the bottom of Table III-1 indicate the response that was obtained by occupational category (*Industrial Hygiene* and *Safety Personnel*) and by occupational level (Technician, In Training, Professional, and Administrator). The larger percentage of respondents was in the *Safety Professional* category (69 percent) while the *Industrial Hygiene* category accounted for 31 percent of the response. Within occupational levels, the largest response was at the In Training level with a total of 55 percent of the respondents classified at this level (18 percent in IH In Training and 37 percent in SP In Training). The In Training occupational level represented those individuals who had the necessary academic training and who may have had the necessary experience to obtain American Board of Industrial Hygiene or Board of Certified Safety Professionals certification but who had not attained certification.

Table III-1. Incumbent Response to Survey Form by SIC

SIC Classifications	Sent	Received	% Response	Industrial Hygiene				Safety Professional			
				Tech	In-Train	Prof	Admin	Tech	In-Train	Prof	Admin
Mining	82	59	72%	2	6	4	2	10	30	2	3
Contract Construction	54	41	76%	1	2	0	0	6	22	6	4
Manufacturing	542	438	81%	8	99	25	28	30	161	54	33
Transportation, Communication, and Utilities	104	77	74%	3	8	2	0	11	34	11	8
Trade, Finance, Insurance, Real Estate	149	132	89%	0	15	9	3	6	50	27	22
Services	160	100	62%	6	19	16	6	2	16	27	8
Government *	1	1	100%	0	0	0	0	0	1	0	0
Totals	1092	848	78%	20	149	56	39	65	314	127	78
% in Level				2%	18%	7%	5%	8%	37%	15%	9%
% in Category				31%				69%			

*One individual apparently had made a recent change in employment from industry to Government.

Summaries of Incumbent Background Data are provided in Appendix III for each of the levels; Technician, In Training, Professional and Administrator. However, the education, experience, responsibilities and certification are discussed in greater detail since they are germain to the terminal objective of this project; the development of performance based curricula. While education and experience may be implied by certification, it is noted that some individuals apparently qualified for certification had not elected to pursue that designation, i.e., a large percent of the In Training occupational level as indicated above.

Data concerning the respondent's academic background are presented in Tables III-2 and III-3.

In terms of the major area of study, the highest percentage of respondents (33.2) indicated receiving a degree in engineering (other than safety engineering). Twenty-five percent of the respondents received a degree in the basic sciences, while 11 percent received a degree in industrial hygiene, and 11 percent received a degree in business administration. Five percent of the respondents received a degree in safety engineering, and 18 percent of the respondents indicated degrees earned in "other" disciplines. Within the *Industrial Hygiene* category, the respondents tended to fall within three major disciplines--basic science (49 percent), engineering (35 percent), and industrial hygiene (32 percent). On the other hand, within the *Safety Professional* category, the disciplines were more varied. Engineering represented the largest percentage of respondents in the *Safety Professional* category (31 percent), business administration (15 percent), basic science (14 percent), and safety engineering (6 percent).

Table III-2. Distribution of Major Areas of Academic Study by Sampled Incumbents

DEGREE AREA - (HIGHEST DEGREE)	Industrial Hygiene						Safety Professional						GRAND TOTAL	% OF TOTAL SAMPLE
	Tech	In-Trn	Prof	Admin	Total IH	% of All IH	Tech	In-Trn	Prof	Admin	Total SP	% of All SP		
Industrial Hygiene														
Associate	0	0	0	0	0	0.0	0	0	1	0	0	0.0	0	0.0
Bachelors	0	1	0	1	2	0.8	0	0	0	0	0	0.0	2	0.2
Masters	0	46	11	11	68	25.8	0	1	1	7	9	1.5	77	9.1
Doctorate	0	4	2	7	13	4.9	0	0	0	0	0	0.0	13	1.5
Safety Engineering														
Associate	1	0	0	0	1	0.4	1	3	3	1	8	1.4	9	1.1
Bachelors	0	1	0	0	1	0.4	0	5	1	1	7	1.2	8	0.9
Masters	0	1	0	1	2	0.8	0	9	6	4	19	3.3	21	2.5
Doctorate	0	0	0	0	0	0.0	0	0	0	1	1	0.2	1	0.1
Engineering (other)														
Associate	0	0	1	1	2	0.8	5	13	5	2	25	4.3	27	3.2
Bachelors	0	40	22	17	79	29.9	0	68	49	25	142	24.4	221	26.1
Masters	0	8	3	1	12	4.5	0	6	4	3	13	2.2	25	3.0
Doctorate	0	3	0	0	0	0.0	0	0	0	0	0	0.0	0	0.0
Basic Science														
Associate	2	2	0	0	4	1.5	5	6	3	3	17	2.9	21	2.5
Bachelors	1	68	21	11	101	38.3	2	31	12	12	57	9.8	158	18.7
Masters	0	7	6	5	18	6.8	1	0	2	1	4	0.7	22	2.6
Doctorate	0	7	1	0	8	3.0	0	2	1	0	3	0.5	11	1.3
Business Administration														
Associate	1	0	0	0	1	0.4	6	6	2	2	16	2.7	17	2.0
Bachelors	0	0	1	0	1	0.4	0	32	10	10	52	8.9	53	6.3
Masters	0	2	0	0	2	0.8	0	15	6	1	22	3.8	24	2.8
Doctorate	0	0	0	0	0	0.0	0	0	0	0	0	0.0	0	0.0
Other														
Associate	0	1	0	0	1	0.4	4	9	6	2	21	3.6	22	2.6
Bachelors	1	12	3	3	19	7.2	2	51	21	9	83	14.2	102	12.6
Masters	0	1	3	1	5	1.9	0	11	6	2	19	3.3	24	2.8
Doctorate	0	1	0	1	2	0.8	0	1	2	0	3	0.5	5	0.6

Table III-3. Distribution of Highest Academic Level Achieved of Sampled Incumbents

HIGHEST ACADEMIC LEVEL ACHIEVED -	Industrial Hygiene						Safety Professional						GRAND TOTAL	% OF TOTAL SAMPLE
	Tech	In-Trn	Prof	Admin	Total IH	% of All IH	Tech	In-Trn	Prof	Admin	Total SP	% of All SP		
Less Than High School	0	0	0	0	0	0	1	1	0	0	2	.3	2	.2
High School Diploma	3	0	0	0	3	1.1	12	15	2	3	32	5.5	35	4.1
Some College - No Degree	12	0	0	0	12	4.5	33	77	19	12	141	24.2	153	18.1
Associate Degree	3	0	0	0	3	1.1	14	17	5	1	37	6.3	40	4.7
Bachelors Degree	1	38	21	7	67	25.4	4	120	50	34	208	35.7	275	32.5
Graduate Study - No Degree	1	32	9	5	47	17.8	1	43	31	12	87	14.9	134	15.8
Masters Degree	0	63	22	20	105	39.8	0	37	17	15	69	11.8	174	20.5
Doctorate	0	16	4	7	27	10.2	0	3	3	1	7	1.2	34	4
No Response	0	0	0	0	0	0	0	1	0	0	1	.2	1	.1

In terms of the highest academic level achieved, 73 percent of the respondents indicated receiving a bachelor's degree or higher. In the *Industrial Hygiene* category, only 7 percent of the respondents indicated an educational level lower than the bachelor's degree; while in the *Safety Professional* category, 36 percent of the respondents indicated receiving training at less than a bachelor's degree.

Three questions on the survey form were related to the work experience of the Incumbents. These were the years in current position; the years with current employer; and the total years full-time work experience. The data presented in Table III-4 indicate the work experience of the respondents. It is evident from these data that a significant level of experience is represented in the sample. The average years in current position for all respondents was 6.4; the average number of years with their current employer was 11.5, and the average total years full-time work experience was 18.4.

Other work experience information is provided in Table III-5. The respondents were asked to indicate which of twelve major types of activities they performed in the *Industrial Hygiene* and *Safety Professional* categories by placing the percent allocation of their time spent in each category. The data obtained from the respondents are presented in Table III-5. A total of 89 percent of the respondents indicated that some portion of their time was spent in the area of identification of hazards, while only 54 percent of the respondents indicated that they spent some portion of their time in the development of alternate controls.

The distribution of responsibility level of the sampled Incumbents is in Table III-6. It is seen that a total of 36.4 percent indicated that their responsibility included the total organization (10.2 percent Industrial Hygiene,

Table III-4. Work Experience Distribution of Sampled Incumbents

	Industrial Hygiene				Safety Professional				
	Tech	In Train	Prof	Admin	Tech	In Train	Prof	Admin	All
Years in Current Position									
Mean	5.4	3.8	7.5	7.0	4.3	6.1	8.0	10.1	6.4
Range									
High	23	23	39	32	30	52	26	39	52
Low	1	1	1	1	1	1	1	1	1
Standard Deviation	6.7	3.6	8.0	7.0	6.0	6.4	6.8	8.3	6.6
Years With Current Employer									
Mean	10.2	7.2	9.8	12.3	11.1	12.3	12.4	16.8	11.5
Range									
High	25	32	32	32	34	41	41	40	41
Low	1	1	1	1	1	1	1	1	1
Standard Deviation	8.9	7.5	9.0	8.6	9.6	10.3	10.2	10.2	9.9
Total Years Full-Time Experience									
Mean	17.9	11.3	22.1	20.7	16.1	18.2	21.9	25.8	18.4
Range									
High	31	39	50	42	40	50	41	49	50
Low	1	1	4	5	1	1	4	4	1
Standard Deviation	10.6	9.2	12.0	9.3	11.7	11.7	9.1	9.2	11.3

Table III-5. Distribution of Time Allocated by Sampled Incumbents to Selected Types of Activity

Time Allocation in	INDUSTRIAL HYGIENE Tech. (N=20)	In-Train. (N=149)	Pro. (N=56)	Admin. (N=39)	Percent of Sample (264=100%)	SAFETY PROFESSIONAL Tech. (N=65)	In-Train. (N=314)	Pro. (N=127)	Admin. (N=78)	Percent of Sample (584=100%)	Percent of Total Sample (848=100%)
Identification of Hazards:											
0%	7	14	3	9	12	2	28	14	17	10	11
>0,<20%	8	68	25	22	47	28	156	63	48	50	49
20 to 49%	4	63	25	8	38	23	96	42	13	30	32
50 to 79%	1	3	3	0	3	12	32	7	0	9	7
80% or more	0	1	0	0	0	0	2	1	0	1	1
Measurement of Hazard Extent:											
0%	7	23	7	16	20	24	95	40	40	34	30
>0,<20%	3	56	21	18	37	36	196	81	37	60	53
20 to 49%	6	62	27	5	38	5	21	6	1	6	16
50 to 79%	2	8	0	0	4	0	1	0	0	0	1
80% or more	2	0	1	0	1	0	1	0	0	0	0
Analysis of Hazard:											
0%	6	29	10	15	23	15	62	21	21	21	21
>0,<20%	7	88	32	20	56	44	213	93	52	69	65
20 to 49%	4	28	13	4	18	6	37	12	5	10	13
50 to 79%	2	3	0	0	2	0	1	1	0	0	1
80% or more	1	1	1	0	1	0	1	0	0	0	0
Development of Alternate Controls:											
0%	13	61	27	23	47	35	150	48	34	46	46
>0,<20%	6	80	27	16	49	29	154	75	41	51	51
20 to 49%	1	8	2	0	4	1	10	3	3	3	3
50 to 79%	0	0	0	0	0	0	0	1	0	0	0
80% or more	0	0	0	0	0	0	0	0	0	0	0

Table III-5. Distribution of Time Allocated by Sampled Incumbents to Selected Types of Activity (continued)

Time Allocation in	INDUSTRIAL HYGIENE					SAFETY PROFESSIONAL					Percent of Total Sample (848=100%)
	Tech. (N=20)	In-Train. (N=149)	Pro. (N=56)	Admin. (N=39)	Percent of Sample (264=100%)	Tech. (N=65)	In-Train. (N=314)	Pro. (N=127)	Admin. (N=78)	Percent of Sample (584=100%)	
Training:											
0%	8	58	18	12	36	13	80	29	24	25	29
>0,<20%	10	86	37	26	60	44	201	83	48	64	63
20 to 49%	1	4	1	1	3	8	32	12	4	10	7
50 to 79%	1	1	0	0	1	0	1	3	2	1	1
80% or more	0	0	0	0	0	0	0	0	0	0	0
Attending Meetings:											
0%	9	38	12	3	24	10	52	12	13	15	18
>0,<20%	9	105	43	26	69	51	246	109	57	79	76
20 to 49%	1	6	1	10	7	4	15	6	8	6	6
50 to 79%	1	0	0	0	0	0	1	0	0	0	0
80% or more	0	0	0	0	0	0	0	0	0	0	0
Planning Programs:											
0%	14	61	26	8	41	14	69	22	13	20	27
>0,<20%	4	68	26	16	43	45	205	91	49	67	59
20 to 49%	1	20	3	10	13	6	38	13	16	12	13
50 to 49%	1	0	1	5	3	0	2	1	0	1	1
80% or more	0	0	0	0	0	0	0	0	0	0	0
Supervising Workers:											
0%	15	95	40	8	60	43	183	91	17	57	58
>0,<20%	3	42	13	14	27	14	95	31	37	30	29
20 to 49%	2	11	3	13	11	7	30	4	13	9	10
50 to 79%	0	0	0	3	1	1	5	1	9	3	2
80% or more	0	1	0	1	1	0	1	0	2	1	1

Table III-5. Distribution of Time Allocated by Sampled Incumbents to Selected Types of Activity (continued)

Time Allocation in	INDUSTRIAL HYGIENE					SAFETY PROFESSIONAL					Percent of Total Sample (848=100%)
	Tech. (N=20)	In-Train. (N=149)	Pro. (N=56)	Admin. (N=39)	Percent of Sample (264=100%)	Tech. (N=65)	In-Train. (N=314)	Pro. (N=127)	Admin. (N=78)	Percent of Sample (584=100%)	
Design of Equipment or Controls:											
0%	18	93	35	26	65	45	208	61	44	61	63
>0,<20%	2	48	18	12	31	20	99	62	33	37	35
20 to 49%	0	8	2	1	4	0	5	3	1	1	2
50 to 79%	0	0	1	0	0	0	2	1	0	1	0
80% or more	0	0	0	0	0	0	0	0	0	0	0
Fire Protection and Control:											
0%	17	127	51	36	87	20	92	35	30	30	48
>0,<20%	2	21	5	3	12	35	185	72	40	57	43
20 to 49%	1	1	0	0	1	8	33	17	7	11	8
50 to 79%	0	0	0	0	0	2	2	3	1	2	1
80% or more	0	0	0	0	0	0	2	0	0	0	0
Presentations:											
0%	18	67	20	11	44	20	80	28	21	26	31
>0,<20%	2	77	34	25	52	36	196	82	50	62	59
20 to 49%	0	5	2	3	4	8	36	16	6	11	9
50 to 79%	0	0	0	0	0	1	2	1	1	1	1
80% or more	0	0	0	0	0	0	0	0	0	0	0
Written Reports:											
0%	5	15	5	5	11	1	28	12	12	9	10
>0,<20%	14	70	25	25	51	48	214	86	55	69	63
20 to 49%	1	61	25	9	36	16	70	27	11	21	26
50 to 79%	0	3	1	0	2	0	2	2	0	1	1
80% or more	0	0	0	0	0	0	0	0	0	0	0

Table III-6. Distribution of Responsible Level of Sampled Incumbents

RESPONSIBILITY LEVEL	Industrial Hygiene						Safety Professional						GRAND TOTAL	% OF TOTAL SAMPLE
	Tech	In-Trn	Prof	Admin	Total IH	% of All IH	Tech	In-Trn	Prof	Admin	Total SP	% of All SP		
Industrial Hygiene -														
Total Organization	1	46	15	24	86	32.6	0	0	0	0	0	0	86	10.2
Region or Group of Locations	2	41	11	3	57	21.6	0	0	0	0	0	0	57	6.7
Single Site	9	26	3	4	42	15.9	0	0	1	0	1	.2	43	5.1
Consulting	0	13	12	1	26	9.8	0	0	0	0	0	0	26	3.1
Safety -														
Total Organization	0	3	0	0	3	1.1	4	37	19	18	78	13.4	81	9.6
Region or Group of Locations	0	0	0	0	0	0	7	36	8	3	54	9.3	54	6.4
Single Site	1	0	0	0	1	.4	6	27	5	4	42	7.2	43	5.1
Consulting	0	0	0	0			3	10	14	3	30	5.1	30	3.5
Both Industrial Hygiene and Safety														
Total Organization	0	5	7	6	18	6.8	10	50	31	32	123	21.1	141	16.6
Region or Group of Locations	3	9	1	0	13	4.9	11	52	17	13	93	16.	106	12.5
Single Site	3	4	1	0	8	3	21	77	14	1	113	19.4	121	14.3
Consulting	0	2	6	1	9	3.4	2	24	18	4	48	8.2	57	6.7
No Response	1	0	0	0	1	.4	1	1	0	0	2	.3	3	.4

9.6 percent Safety Professional, 16.6 percent both Industrial Hygiene and Safety Professional). Twenty-six percent indicated that their responsibility covered a region or group of locations; 24.5 percent responded that they were responsible for a single site, while 13.3 percent indicated a responsibility for consulting. Twenty-five percent of the respondents indicated that they considered themselves responsible for industrial hygiene alone, while another 25 percent indicated that they were responsible for safety alone. Fifty percent of the respondents indicated they were responsible for both industrial hygiene and safety.

Eight different certification or registration classifications along with an "other" classification were presented in the survey form. The data obtained from the responses to this section of the survey form are presented in Table III-7. The largest number of respondents were in the BCSP certification category (30 percent). A total of 13 percent of the respondents was certified by the ABIH, and 14 percent of the respondents indicated having attained Professional Engineering Registration. The In Training occupational level indicates that the respondents have either acquired the academic qualifications or passed the certification examination but have not attained the necessary experience to become certified by the respective Boards; ABIH or BCSP.

Within the ABIH certification, the largest number of respondents who indicated that they held this certification received certification in Comprehensive Practice (76 percent). Another 7 percent indicated receiving certification in the Engineering Aspects with 3 percent or less of the respondents indicating certification in any of the other five areas (Chemical, Toxicological, Radiological, Air Pollution, and Acoustical).

Table III-7. Distribution of Certification or Registration of Sampled Incumbents

TYPE	Industrial Hygiene						Safety Professional						GRAND TOTAL	% OF TOTAL SAMPLE
	Tech	In-Trn	Prof	Admin	Total IH	% of All IH	Tech	In-Trn	Prof	Admin	Total SP	% of All SP		
ABIH	0	0	58	39	97	36.7	0	0	5	7	12	2.1	109	12.9
BCSP	0	12	24	16	52	19.7	0	0	127	78	205	35.2	257	30.3
ABIH in Training	0	27	0	0	27	10.2	0	0	0	0	0	0	27	3.2
BCSP in Training	0	4	0	0	4	1.5	0	24	1	0	25	4.3	29	3.4
State Industrial Hygiene Certification	0	2	1	2	5	1.9	0	1	2	1	4	.7	9	1.1
State Safety Certification	0	0	0	0			1	16	9	9	35	6	35	4.1
Environmental Engineering Society	0	0	1	2	3	1.1	0	1	0	2	3	.5	6	.7
Professional Engineer	0	11	13	8	32	12.1	0	26	32	25	83	14.2	115	13.6
Other	1	11	2	4	18	6.8	4	12	5	3	24	4.1	42	5

Responses to the Task/Activity Survey Form -

The responses to the individual tasks/activities by the incumbent personnel are summarized in Appendix IV, "A Summary of the Incumbent Personnel Responses for Each Task/Activity: Percentage of Sampled Incumbent Personnel Indicating the Task/Activity is Performed and the Criterion Level of Performance." Appendix IV presents for each task/activity the percentage of sampled Incumbent personnel indicating a task/activity is "performed" by occupational levels within each professional category. That is, the responses of "performed frequently" and "performed occasionally" were combined and converted to a percentage representing the frequency with which the task/activity was "performed". Appendix IV also gives, for each task/activity, the associated "criterion level of performance" (i.e., performed by one-third of the Incumbents in a specific occupational or performed by one-half or performed by two-thirds).

The "criterion level of performance" was determined by testing the observed percentage of the sample indicating a task/activity was performed with a desired criterion percentage value (i.e., 33%, 50%, or 67%). The null hypothesis was that there was no significant difference between the observed percentage and the criterion percentage; the alternative hypothesis was that the observed percentage was significantly greater than the criterion percentage at a significance level (α) of 0.05. Becuase of the inherent uncertainty associated with making inferences about a population from a sample, this test insured (with 95% confidence) that a task/activity would not be stated as being "performed" by the Incumbent personnel unless the value of the sample percentage was significantly greater than a selected criterion value.

Table III-8 gives the critical sample (observed) percentage values necessary to meet the criterion percentage values of: greater than 33%, greater than 50%, and greater than 67%. It is noted from Table III-8, that the greater the uncertainty of a sample value (i.e., one obtained from a smaller sample size) the higher will be the critical sample percentage value necessary to meet a designated criterion percentage value. For example, in order to meet the criterion value of performed by "greater than 33%" of the population, the observed percentage value obtained from the Industrial Hygiene Technician sample of 20 responses must be equal to or greater than 51%; whereas, for the Industrial Hygiene In Training sample of 149 responses, the observed percentage value must only be equal to or greater than 40%.

The incumbent data presented in Appendix IV was evaluated using the criterion values shown in Table III-8 and the resulting assignments of occupational level by the incumbents are presented for two criterion levels of performance (1/3 and 1/2) in Appendix II of Technical Report IV-A, Correlation Between Level of Assignment by Expert Practitioners and Incumbent Personnel for Tasks/Activities in the Safety Professional and Industrial Hygiene Professions. The "1/3" criterion includes all tasks/activities in which greater than 33% of an Incumbent personnel occupational level (Technician, In Training, Professional, Administrator) indicated the tasks/activities as being performed; the "1/2" criterion includes all tasks/activities in which greater than 50% of an Incumbent personnel occupational level indicated them as being performed.

As an example, using task/activity number 1 "Maintain Required OSHA Records", the percentage of the sampled Incumbent IH Technicians indicating that task/activity number 1 is performed was 55 percent. Since the observed percentage (55) is greater than the critical percentage value of 51 for the

Table III-8. Critical Sample Percentage Values Necessary to Meet the Designated Criterion Percentage Values

Criterion Percentage	INDUSTRIAL HYGIENE				
		Tech. (n=20)	In Train. (n=149)	Pro. (n=56)	Admin. (n=39)
33.3		51	40	44	46
50.0		69	57	61	64
66.7		85	73	77	79

Criterion Percentage	SAFETY PROFESSIONAL				
		Tech. (n=20)	In Train. (n=149)	Pro. (n=56)	Admin. (n=39)
33.3		43	38	40	42
50.0		60	55	57	59
66.7		76	71	74	76

33% criterion level, but is less than the critical percentage value of 69 for the 50% criterion level, it may be stated that the observed percentage (55) is significantly greater than 33% but not greater than 50%. Or, stated more simply, more than 33% (but not more than 50%) of the IH Technicians perform task/activity number 1.

In Technical Report III it was shown from the prerequisite knowledge data that there was a high correlation between the "Technician" (1) level of assignment and the "Acquisition of Data/Measurement of Exposures" (B) function classification, and a similarly high correlation between the "Professional/Administrator" (3, 3-4, 4) level of assignment and the "Analysis of Data/Evaluation of Measurement Results" (C) and "Control of Exposures" (D) function classification for the Expert Practitioner responses.

Table III-9 summarizes the relationship between the level of assignment and function classification for selected incumbent personnel responses. The tasks/activities selected were classified as purely B, C, or D. No tasks were included which were assigned to all levels (i.e., 1-2-3-4) or which had multiple classifications (e.g., B-C, B-C-D). It is noted that there were 14 tasks/activities assigned to the IH Technician or In Training levels (1, 1-2, 2) by the Incumbent personnel. Of these, 43% were classified with a "B" function and 57% with a "C" or "D" function. There were 68 tasks/activities assigned to the IH Professional or Administrator levels (3, 3-4, 4). Of these, 12% were classified with a "B" function and 88% with a "C" or "D" function. The difference between the percentages (43 vs. 12) was tested for significance ($\alpha = .05$) and it was determined that the 43% was significantly greater than the 12%. That is, at the 1/3 criterion level of performance, the percentage of IH Technician and In Training level tasks/activities that are classified as "B" function is significantly greater than the percentage of Professional and Administrator tasks/activities that are classified as "B" function. Conversely, the percentage of IH Professional and Administrator tasks/activities that are classified as "C" or "D" function (88%) is significantly greater than the percentage of Technician and In Training tasks/activities that are classified as "C" or "D" function (57%). The same conclusions apply also to the Safety Professional data of Table III-9 (i.e., 24%, 7%, 93%, 76%). Thus, the relationship between task/activity level of assignment and function classification found for the Expert Practitioner data holds also for the incumbent data.

The following conclusions may be drawn from the responses of the Incumbent personnel:

1. The 848 individuals sampled from the population of persons employed in the *Industrial Hygiene* category and the *Safety Professional* category at four occupational levels is of significant size to accurately describe the population.
2. Individuals employed in the *Industrial Hygiene* and the *Safety Professional* categories tend to be well educated with a predominance of persons holding at least a bachelors degree. The major areas of study for the majority of individuals are the academic disciplines of science and engineering.
3. There does not seem to be a large difference between individuals employed in the *Industrial Hygiene* category and the *Safety Professional* category in terms of the tasks/activities that are performed. However, there are differences in the frequency levels at which the tasks/activities are performed. This is particularly true when considering those areas that are normally assumed to be primarily the responsibility of the *Industrial Hygiene* category, i.e., air quality, physical hazards, and hazardous materials. In these areas, a significant portion of

Table III-9

Summary of Selected Incumbent Responses: Relationship Between Task Level Assignment and Function Classification

(Criterion Level of Performance = 1/3)

	Hygiene Professional Task Level Assignment		Safety Professional Task Level Assignment	
	1,1-2,2	3,3-4,4	1,1-2,2	3,3-4,4
Number of Tasks (n)	14	68	17	55
Percent of Tasks that are "B"*	43	12	24	7
Percent of Tasks that are "C" or "D"*	57	88	76	93

* B - Acquisition of data/measurement of exposures

C - Analysis of data/evaluation of measurement results

D - Control of exposures

the respondents in the *Safety Professional* category indicated performing these types of tasks/activities. Again, the frequency level at which respondents in the *Safety Professional* category perform these tasks/activities is normally lower than the frequency level at which the respondents in the *Industrial Hygiene* category perform them. Conversely, the same can be said for those areas normally assumed to be primarily the responsibility of the *Safety Professional* category, i.e., mechanical and electrical hazards, flammable materials, materials handling and facilities. Most often, the *Safety Professional* category performed the tasks/activities in these areas at a higher frequency level than did the *Industrial Hygiene* category.

4. There is, for the Incumbent personnel responses, a relationship between task/activity level of assignment and function classification similar to the relationship found for the Expert Practitioner responses. That is, Technicians perform more "Acquisition of Data/Measurement of Exposure" tasks and activities; Professionals and Administrators perform more "Analysis of Data/Evaluation of Measurement Results" and "Control of Exposures" tasks and activities.

DISCUSSION

In observing the incumbent background data presented in Table III-2, it is noted that the graduate level education is more prevalent in the *Industrial Hygiene* category than in the *Safety Professional* category. From Table III-2, it is seen that for the IH In Training occupational level 65 masters degrees (65/149 = 44%) were reported and 15 doctoral degrees (15/149 = 10%) as contrasted with 42 masters degrees (42/341 = 13%) and 3 doctoral degrees (3/314 = 1%) for the SP In Training level.

From Table III-5 comparisons of time allocated to specific types of activity can be made between occupational categories and between occupational levels within or between categories. For the "identification of hazards," "analysis of hazard," "development of alternate controls," "design of equipment or controls," "written reports," "training," "attending meetings," and "supervising workers" activities there is very similar allocation of time between the *Industrial Hygiene* and *Safety Professional* categories. However, it appears that more time is allocated by respondents in the *Industrial Hygiene* category to the "measurement of hazard extent" activity than by those in the *Safety Professional* category. Conversely, it appears that more time is allocated by the Safety Professional personnel to "fire protection and control," "presentations," and "planning programs" activities than by the Industrial Hygiene personnel.

SUMMARY

The current activity being performed in the field of occupational safety and health in American Industry was determined by sampling 848 Incumbent personnel representing four occupational levels (Technicians, In Training, Professional, and Administrator) within the occupational categories of *Industrial Hygiene* and *Safety Professional*. The survey form to which the Incumbent personnel responded consisted of questions regarding the frequency of performance of a list of 753 tasks and activities considered to encompass the activity of the *Industrial Hygiene* and *Safety Professional* categories. The survey form also was used to obtain a wealth of data regarding the Incumbent's personal and professional background which is used to describe in detail characteristics of the sampled population.

The Incumbent responses to the list of task/activity questions on the survey form were tabulated and analyzed statistically to determine at what occupational level(s) within the two categories, *Industrial Hygiene* and *Safety Professional*, each task/activity is currently being performed. This data, in conjunction with the data collected on the same survey form from the study's selected group of Expert Practitioners, is used in the development of curricula for preparing individuals to enter at the various levels of employment in occupational safety and health.

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CHAPTER IV

CONSOLIDATION OF EXPERT PRACTITIONER AND INCUMBENT DATA

Objective IV.

To correlate, merge, and consolidate the data gathered in Objectives 1, 2, and 3 to derive reasonable and practical job requirements, including skills and knowledge.

BACKGROUND/OVERVIEW

The purpose of Objective 4 was to relate and blend the data collected from Expert Practitioners, Incumbent personnel and Industry job descriptions regarding job skills, knowledge and requirements to aid in the definition and development of performance-related curricula for preparing individuals to enter the various occupational levels in the *Industrial Hygiene* and *Safety Professional* categories.

The results of data analyses of Expert Practitioners and Incumbents were presented in previous sections of this report and, therefore, will not be repeated. However, a contingency correlation analysis describing the relationship between the level-of-assignment responses made by the Expert Practitioners and the responses made by the Incumbent personnel to the survey form's list of 753 tasks/activities is presented. Moreover, a composite picture of the job requirements, skills, and knowledge required of the Industrial Hygiene Technician, In Training, Professional and Administrator and the Safety Professional Technician In Training, Professional, and Administrator is also presented.

PROCEDURES

The inputs used to achieve Objective 4 are described in the following summary.

Expert Practitioner Data - responses from 30 Expert Practitioners (15 *Industrial Hygienists*, 15 *Safety Professionals*) to a task/activity survey form were analyzed to determine the occupational level at which each task/activity should be performed within the two categories (*Industrial Hygiene* and *Safety Proressional*) and the education/training requirements for each task/activity.

In determining the occupational level at which each task/activity should be performed, each Expert Practitioner completed the survey form independently and was given the following instructions:

"We are asking you to provide us your opinion relative to tasks/activities performed within two professional areas, industrial hygiene and safety professional. Furthermore, we seek your opinion as to the lowest level of performance of the tasks/activities. The various levels of individuals performing the task are defined below.

0 - not performed at any level (the task/activity is not within the scope of industrial hygiene/safety professional).

1 - performed by technicians (individuals with at least two years of education and/or training or the equivalent in skills related to industrial hygiene/safety professional).

2 - performed by those in training (individuals meeting the academic requirements for certification in industrial hygiene or safety professional but who have not acquired the experience necessary for certification).

3 - performed by professionals (individuals meeting the academic and experience requirements for certification in industrial hygiene or safety professional. NOTE: Successful completion of the qualification examinations is excluded from this definition).

4 - performed by administrators (individuals who are primarily administrators even though they may possess professional qualifications)."

Statistical analyses of the data permitted the varied responses of the Expert Practitioners to be reduced in a manner to determine:

1. If any given task/activity was or was not performed by *Industrial Hygiene* or *Safety Professional* categories,
2. if there was a statistically significant difference between the distribution of responses made by the *Industrial Hygiene* Experts and that of the *Safety Professional* Experts for any given task/activity, and
3. at what one level (1, 2, 3, or 4) or combined levels (1-2, 1-2-3, 2-3, or 3-4) did the Expert Practitioners assign a given task/activity.

The assignments resulting from the analysis of the Expert Practitioner data are discussed earlier in this report and are covered in detail in Technical Report III.

Incumbent Personnel Data - responses from 848 Incumbent personnel to the task/activity survey form were analyzed to determine for each task/activity the percentage of the sampled Incumbent personnel indicating the task/activity is "performed", and the associated "criterion level of performance" (i.e., 1/3, 1/2, or 2/3).

The "criterion level of performance" was determined by testing the observed percentage of the sample indicating a task/activity is performed with a desired criterion percentage value (i.e., 33%, 50%, or 67%). The null hypothesis was that there was no significant difference between the observed percentage and the criterion percentage. The alternative hypothesis was that the observed percentage was significantly greater than the criterion percentage; the significance level (α) used was 0.05. The assignments resulting from the analysis of the Incumbent responses to the task/activity survey form are included in Appendix II of Technical Report IV-A.

Job Description Data - Job descriptions from 21 industry representatives for 50 individual *Industrial Hygiene* and *Safety Professional* positions were analyzed to determine their preferred and alternate education and experience requirements. Analyses were also performed to determine which occupational levels (Technician, In Training, and Professional) were preliminary steps for other levels, and which were terminal levels.

RESULTS

Contingency Correlation Analysis - to measure the extent of association between the two sets of responses (Expert Practitioners vs. Incumbent personnel) of level-of-assignment for the 753 tasks/activities listed in the survey form, a contingency correlation analysis was performed. Tables IV-1, 2, 3, and 4 summarize the frequency distributions and relationships between the responses of the Practitioners and the Incumbents.

The 11 response classes in Tables IV-1, 2, 3, and 4 are defined as follows:

N - Not performed

1 - Performed at Technician level

2 - Performed at In Training level

(1-2) - Performed at Technician and In Training levels

(1-2-3) - Performed at Technician, In Training, and Professional levels

(1-2-3-4) - Performed at Technician, In Training, Professional, and Administrator levels

(2-3-4) - Performed at In Training, Professional, and Administrator levels

(2-3) - Performed at the In Training and Professional levels

(3-4) - Performed at Professional and Administrator levels

3 - Performed at Professional level

4 - Performed at Administrator level

It is seen in Table IV-1 that 275 of the 753 tasks/activities were indicated as "not performed" (N) by both the *Industrial Hygiene* Expert Practitioner group and the *Industrial Hygiene* Incumbent personnel when the criterion level of performance was one-third. As the criterion level of performance was increased from one-third to one-half (Table IV-2), the number of tasks/activities indicated as "not performed" by the *Industrial Hygiene* Practitioners and the *Industrial Hygiene* Incumbents increased to 305. Table IV-3 shows that 120 tasks/activities were indicated as "not performed" by both *Safety Professional* groups when the criterion level of performance of 1/2 (Table IV-4).

To facilitate computing valid contingency coefficients, the number of response classes used in Tables IV-1, 2, 3, and 4 were reduced from 11 to 4. The resulting contingency tables along with the computation of the corresponding contingency coefficients are presented in Tables IV-5, 6, 7, and 8.

Each cell of the contingency tables contains an observed frequency and an "independence" value in parentheses. The independence values give the number of matched responses to be expected on the hypothesis of chance. To determine the independence value of a given cell the cell's row total is multiplied by its column total and divided by 753. The contingency coefficient is determined as shown in Tables IV-5, 6, 7, and 8 by comparing the observed frequencies with the independence values.

Although the value of "C" cannot be compared to a Pearson product-moment correlation coefficient (r), it can be tested for "significance" by using a X^2-test. In testing the significance of a measure of association (C) we are testing the null hypothesis that there is no correlation in the population (i.e., that the observed frequency in the sample could have occurred by chance in a random sample from a population in which the two

Table IV-1

Frequency Distribution of Task/Activity Level Assignments Made by the Industrial Hygiene Expert Practitioner Group and Industrial Hygiene Incumbent Personnel

(Criterion Level of Performance = 1/3)

Incumbent Responses

Expert Practitioner Responses	N	1	2	1-2	1-2-3	1-2-3-4	2-3-4	2-3	3-4	3	4	TOTAL
N	275	0	3	0	0	1	4	0	1	1	23	308
1	5	1	0	1	0	9	7	0	0	0	1	24
2	0	0	0	0	0	1	0	0	0	0	1	2
1-2	18	0	4	1	0	51	36	9	0	1	4	124
1-2-3	7	0	1	0	0	0	2	0	0	0	0	10
1-2-3-4	52	0	0	0	0	4	23	1	1	1	8	90
2-3-4	0	0	0	0	0	0	0	0	0	0	0	0
2-3	22	0	3	0	0	19	73	6	0	0	12	135
3-4	1	0	0	0	0	0	7	0	0	0	7	15
3	4	0	1	0	0	0	26	1	3	0	9	44
4	0	0	0	0	0	0	0	0	0	0	1	1
TOTAL	384	1	12	2	0	85	178	17	5	3	66	753

Table IV-2

Frequency Distribution of Task/Activity Level Assignments Made by the Industrial Hygiene Expert Practitioner Group and Industrial Hygiene Incumbent Personnel

(Criterion Level of Performance = 1/2)

	Incumbent Responses											
Expert Practitioner Responses	N	1	2	1-2	1-2-3	1-2-3-4	2-3-4	2-3	3-4	3	4	TOTAL
N	305	0	0	0	0	0	1	0	1	0	1	308
1	7	0	1	0	0	6	9	1	0	0	0	24
2	1	0	0	0	0	1	0	0	0	0	0	2
1-2	54	0	3	0	2	19	33	6	1	3	3	124
1-2-3	9	0	1	0	0	0	0	0	0	0	0	10
1-2-3-4	70	0	2	0	0	2	9	1	1	1	4	90
2-3-4	0	0	0	0	0	0	0	0	0	0	0	0
2-3	51	0	6	0	0	3	53	2	0	0	20	135
3-4	5	0	0	0	0	0	1	0	2	0	7	15
3	14	0	2	0	0	0	14	1	1	0	12	44
4	1	0	0	0	0	0	0	0	0	0	0	1
TOTAL	517	0	15	0	2	31	120	11	6	4	47	753

Table IV-3

Frequency Distribution of Task/Activity Level Assignments Made by the Safety Professional Expert Practitioner Group and Safety Professional Incumbent Personnel

(Criterion Level of Performance = 1/3)

Incumbent Responses

Expert Practitioner Responses	N	1	2	1-2	1-2-3	1-2-3-4	2-3-4	2-3	3-4	3	4	TOTAL
N	120	0	2	0	0	6	3	0	1	1	3	136
1	11	0	0	1	1	12	2	1	0	0	0	28
2	0	0	0	0	0	0	0	0	0	0	0	0
1-2	24	0	5	2	3	94	13	5	3	0	1	150
1-2-3	1	0	0	1	0	5	0	0	0	0	0	7
1-2-3-4	37	0	4	2	1	118	28	0	3	0	18	211
2-3-4	0	0	0	0	0	0	0	0	0	0	0	0
2-3	11	0	3	1	0	89	18	1	0	0	11	134
3-4	3	0	1	0	0	13	6	0	0	0	4	27
3	4	0	0	0	1	25	8	0	1	0	19	58
4	0	0	0	0	0	1	1	0	0	0	0	2
TOTAL	211	0	15	7	6	363	79	7	8	1	56	753

Table IV-4

Frequency Distribution of Task/Activity Level Assignments Made by the Safety Professional Expert Practitioner Group and Safety Professional Incumbent Personnel

(Criterion Level of Performance = 1/2)

	Incumbent Responses											
Expert Practitioner Responses	N	1	2	1-2	1-2-3	1-2-3-4	2-3-4	2-3	3-4	3	4	TOTAL
N	131	0	0	0	0	1	1	3	0	0	0	136
1	17	0	2	1	0	4	3	0	0	1	0	28
2	0	0	0	0	0	0	0	0	0	0	0	0
1-2	58	0	4	3	4	60	11	3	0	0	7	150
1-2-3	4	0	2	1	0	0	0	0	0	0	0	7
1-2-3-4	84	0	5	4	0	61	32	3	0	0	22	211
2-3-4	0	0	0	0	0	0	0	0	0	0	0	0
2-3	33	0	3	0	0	54	25	1	2	0	16	134
3-4	13	0	0	0	0	9	2	0	0	0	3	27
3	11	0	1	0	0	10	12	0	1	0	23	58
4	1	0	0	0	0	0	0	0	0	0	1	2
TOTAL	352	0	17	9	4	199	86	10	3	1	72	753

variables--level of assignment responses by experts and incumbents--were not correlated). The X^2-test may be used because the contingency coefficient (C) is related to X^2- as shown in Tables IV-5, 6, 7, and 8. The values of "C" computed in Tables IV-5, 6, 7, and 8 are all highly significant (i.e., the probability of occurrence under the null hypothesis is less than .001). Thus, it is concluded that in each case (Tables IV-5, 6, 7, and 8) the value of "C" is significantly different from zero, and therefore, there is a significant association between the responses made by the Experts and those made by the Incumbents. It is noted that the association between Expert responses and Incumbent responses is slightly stronger (i.e., values of "C" are higher) when the criterion level of performance of 1/3 is used.

Knowledge, Skill, and Job Requirements Composite for the *Industrial Hygiene* Technician and the *Safety Professional* Technician -

Knowledge Requirements - Table IV-9 presents a condensed summary of the prerequisite knowledge rankings reported by the Expert Practitioners in Chapter II. It is seen from this summary that the "Associate" degree is the predominant academic level for both occupational categories. It is also observed that the same subject matter is included in the top 10 categories for both the IH Technician and the SP Technician, only the relative positions in the top 10 categories were different.

Skill Requirements - Figures IV-1 and IV-2 present the profiles of the Incumbent IH Technician and the SP Technician, respectively, indicating the percent of time allocated to selected activities. The data used to develop the profiles are given in Table III-5 of Chapter III. From these profiles it is seen that the majority of the Technicians time is devoted to the identification of hazards and the measurement of hazard extent and they must therefore possess the skills necessary to perform those tasks/activities.

Table IV-5

Contingency Table Formed From Data of Table IV-1

(Industrial Hygiene Responses: Criterion Level of Performance = 1/3)

Expert Practitioner Responses	Incumbent Responses				
	N	1,1-2,2	1-2-3 1-2-3-4 2-3,2-3-4	3,3-4,4	TOTAL
N	275 (157)	3 (6)	5 (115)	25 (30)	308
1,1-2,2	23 (76)	7 (3)	113 (56)	7 (15)	150
1-2-3 1-2-3-4 2-3 2-3-4	81 (120)	4 (5)	128 (87)	22 (23)	235
3,3-4,4	5 (31)	1 (1)	34 (22)	20 (6)	60
TOTAL	384	15	280	74	753 = N

$$S = \frac{(275)^2}{157} + \frac{(23)^2}{76} + \ldots + \frac{(20)^2}{6} = 1147$$

$$C \text{ (contingency coefficient)} = \sqrt{\frac{S-N}{S}} = +.59$$

$$(x^2 = \frac{NC^2}{1-C^2} = 631, \text{ @ } 9 \text{ df})$$

Table IV-6

Contingency Table Formed From Data of Table IV-2

(Industrial Hygiene Responses: Criterion Level of Persormance = 1/2)

Expert Practitioner Responses	Incumbent Responses				
	N	1,1-2,2	1-2-3 1-2-3-4 2-3,2-3-4	3,3-4,4	TOTAL
N	305 (211)	0 (6)	1 (67)	2 (23)	308
1,1-2,2	62 (103)	4 (3)	77 (33)	7 (11)	150
1-2-3 1-2-3-4 2-3 2-3-4	130 (161)	9 (5)	70 (51)	26 (18)	235
3,3-4,4	20 (41)	2 (1)	16 (13)	22 (5)	60
TOTAL	517	15	164	57	753 = N

$$S = \frac{(305)^2}{211} + \frac{(62)^2}{103} + \ldots + \frac{(22)^2}{5} = 1053$$

C (contingency coefficient) $= \sqrt{\frac{S-N}{S}} = +.53$

$$(x^2 = \frac{NC^2}{1-C^2} = 456, \text{ @ 9 df})$$

Table IV-7

Contingency Table Formed From Data of Table IV-3

(Safety Professional Responses:
Criterion Level of Performance = 1/3)

Expert Practitioner Responses	Incumbent Responses: N	1,1-2,2	1-2-3 1-2-3-4 2-3,2-3-4	3,3-4,4	TOTAL
N	120 (38)	2 (4)	9 (82)	5 (12)	136
1,1-2,2	35 (50)	8 (5)	131 (108)	4 (15)	178
1-2-3 1-2-3-4 2-3,2-3-4	49 (99)	11 (10)	260 (213)	32 (30)	352
3,3-4,4	7 (24)	1 (3)	55 (53)	24 (8)	87
TOTAL	211	22	455	65	753 = N

$$S = \frac{(120)^2}{38} + \frac{(35)^2}{50} + \ldots + \frac{(24)^2}{8} = 1100$$

$$C \text{ (contingency coefficient)} = \sqrt{\frac{S-N}{S}} = +.56$$

$$\left(\chi^2 = \frac{NC^2}{1-C^2} = 346, \text{ @ } 9 \text{ df}\right)$$

Table IV-8

Contingency Table Formed From Data of Table IV-4

(Safety Professional Responses:

Criterion Level of Performance = 1/2)

Incumbent Responses

Expert Practitioner Responses	N	1,1-2,2	1-2-3 1-2-3-4 2-3,2-3-4	3,3-4,4	TOTAL
N	131 (64)	0 (5)	5 (54)	0 (14)	136
1,1-2,2	75 (83)	10 (6)	85 (71)	8 (18)	178
1-2-3 1-2-3-4 2-3,2-3-4	121 (161)	15 (12)	176 (137)	40 (35)	345
3,3-4,4	25 (41)	1 (3)	33 (35)	28 (9)	87
TOTAL	352	26	299	76	753 = N

$$S = \frac{(131)^2}{64} + \frac{(75)^2}{83} + \ldots + \frac{(28)^2}{9} = 974$$

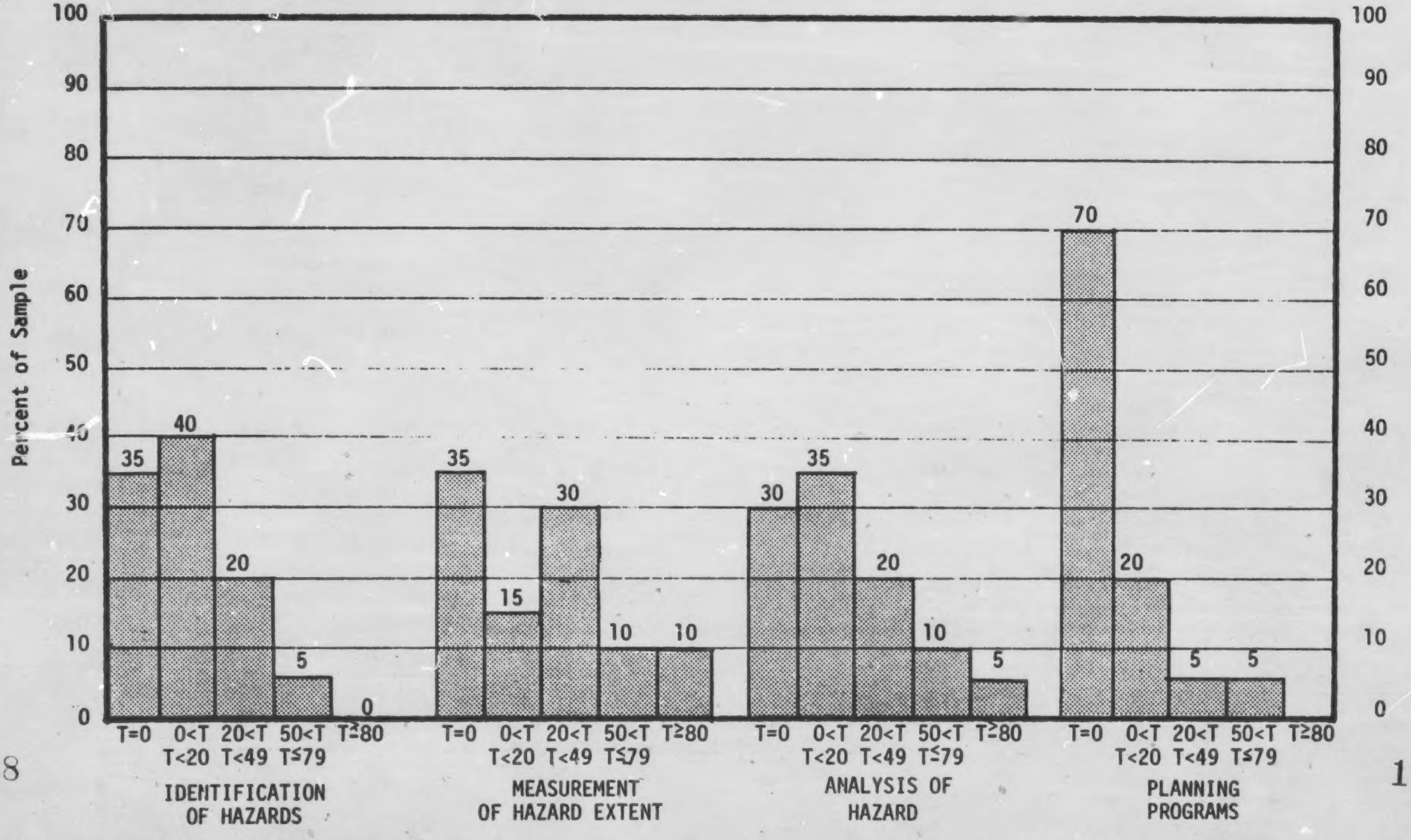
$$C \text{ (contingency coefficient)} = \sqrt{\frac{S-N}{S}} = +.48$$

$$\left(x^2 = \frac{NC^2}{1-C^2} = 222, \text{ @ 9 df}\right)$$

Table IV 9. Technician Knowledge Requirements: Ranking of Top 10 Academic Subject Matter Categories by Expert Practitioners

	INDUSTRIAL HYGIENE		SAFETY PROFESSIONAL	
Rank	Subject Matter	Academic Level	Subject Matter	Academic Level
1	Physical Sciences	Associate	Industrial Hygiene	Associate
2	Industrial Hygiene	Associate	Safety Engineering	Associate
3	Biological Sciences	Associate	Physical Sciences	Associate
4	Safety Engineering	Associate	Biological Sciences	Associate
5	Mathematical Sciences	Associate	Engineering Sciences	Associate
6	Liberal Arts	Associate	Industrial Engineering	Associate
7	Mechanical Arts	Associate	Mathematical Sciences	Associate
8	Engineering Sciences	Associate	Liberal Arts	Associate
9	Industrial Engineering	Associate	Mechanical Arts	Associate
10	Management Sciences	Associate	Management Sciences	Associate

Figure IV-1. Industrial Hygiene Technician Skill Requirements: Profile of Percent of Time (T) Allocated by Sampled Incumbents to Selected Activities



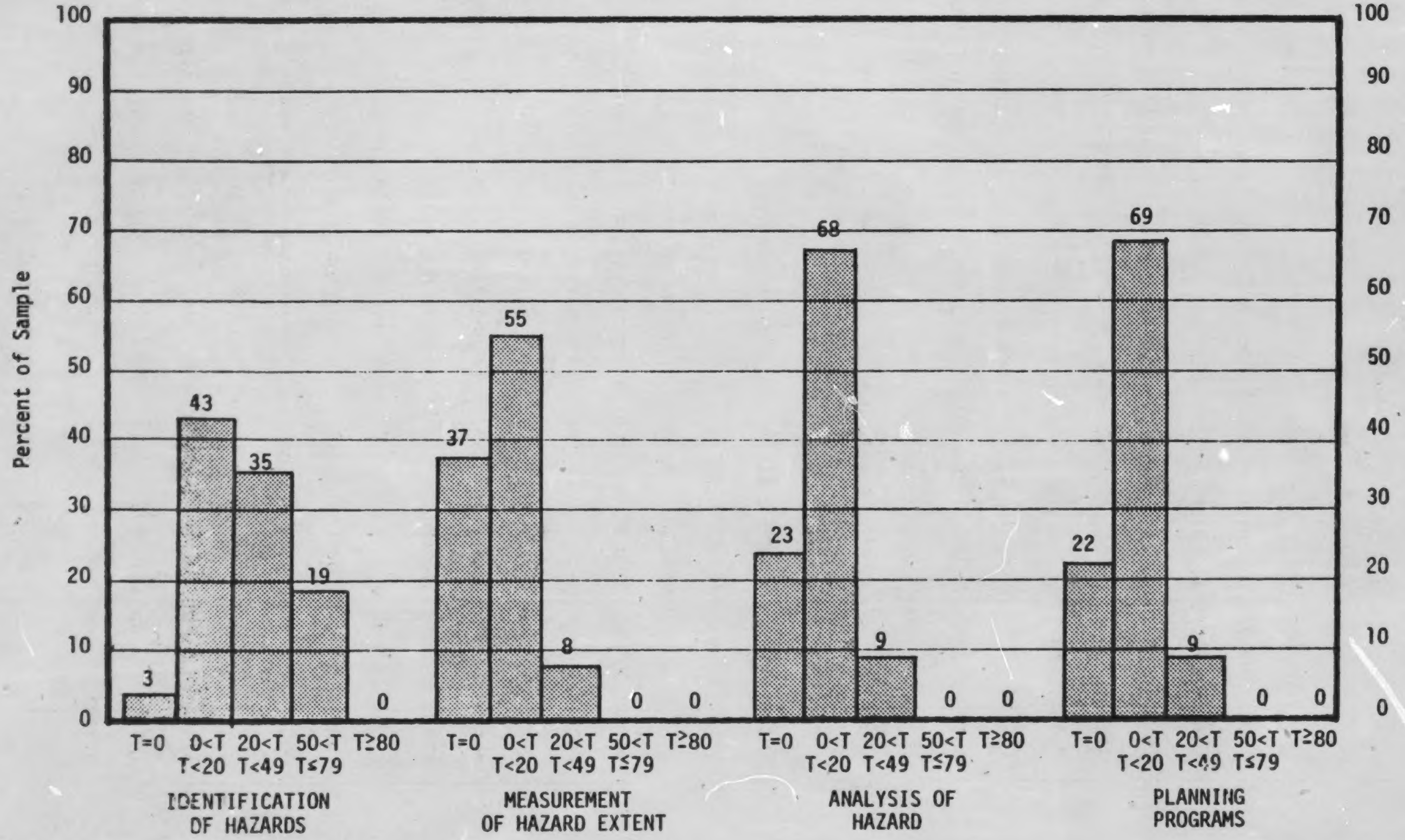


Figure IV-2. Safety Professional Technician Skill Requirements: Profile of Percent of Time (T) Allocated by Sampled Incumbents to Selected Activities

Job Requirements - Table IV-10 presents the job requirements of years education and experience stipulated in the job descriptions provided by Contact Persons. Although there is no significant difference between the SP Technician and the IH Technician in the number of years experience required in the job descriptions, the mean years of education required of the IH Technician (17.4) was significantly greater than that of the SP Technician (14.8). Figure IV-3 presents a chronological view of the mean experience data reported by the Incumbent Technicians. The Incumbent Technicians also indicated their job requirements by reporting their highest academic level achieved. A profile of this data is presented in Figure IV-4. The profiles for both occupational categories were similar; the highest percentage of the Technicians had some college study but no degree.

DISCUSSION (Technician)

From these data it is seen that the IH and SP Technicians have much in common with regard to their experience, skills, and knowledge requirements. Both require about 2 to 4 years of experience to become Technicians, both perform primarily "identification of hazards" and "measurement of hazard extent" tasks/activities, and both generally require some college study with the Associate academic level being most desirable.

Although a great mass of data has been collected regarding the job requirements of occupational safety and health personnel, it is strongly emphasized that this information represents only the responses of representatives of industry, both Expert Practitioners and Incumbents, as required by the contract. No conclusions may be drawn from these data regarding the *Industrial Hygiene* and *Safety Professional* functions within government organizations.

Table IV-10. Technician Job Requirements: Years of Education and Experience Stipulated in Job Descriptions

	Mean Required Education (Yrs)	Mean Required Experience (Yrs)*
Safety Professional	14.8	3.6
Industrial Hygiene	17.4	1.6

*means connected by a common line are not significantly different ($\alpha = .05$)

Figure IV-3. Technician Job Requirements: Calendar of Experience for the "Average" Incumbent Sampled

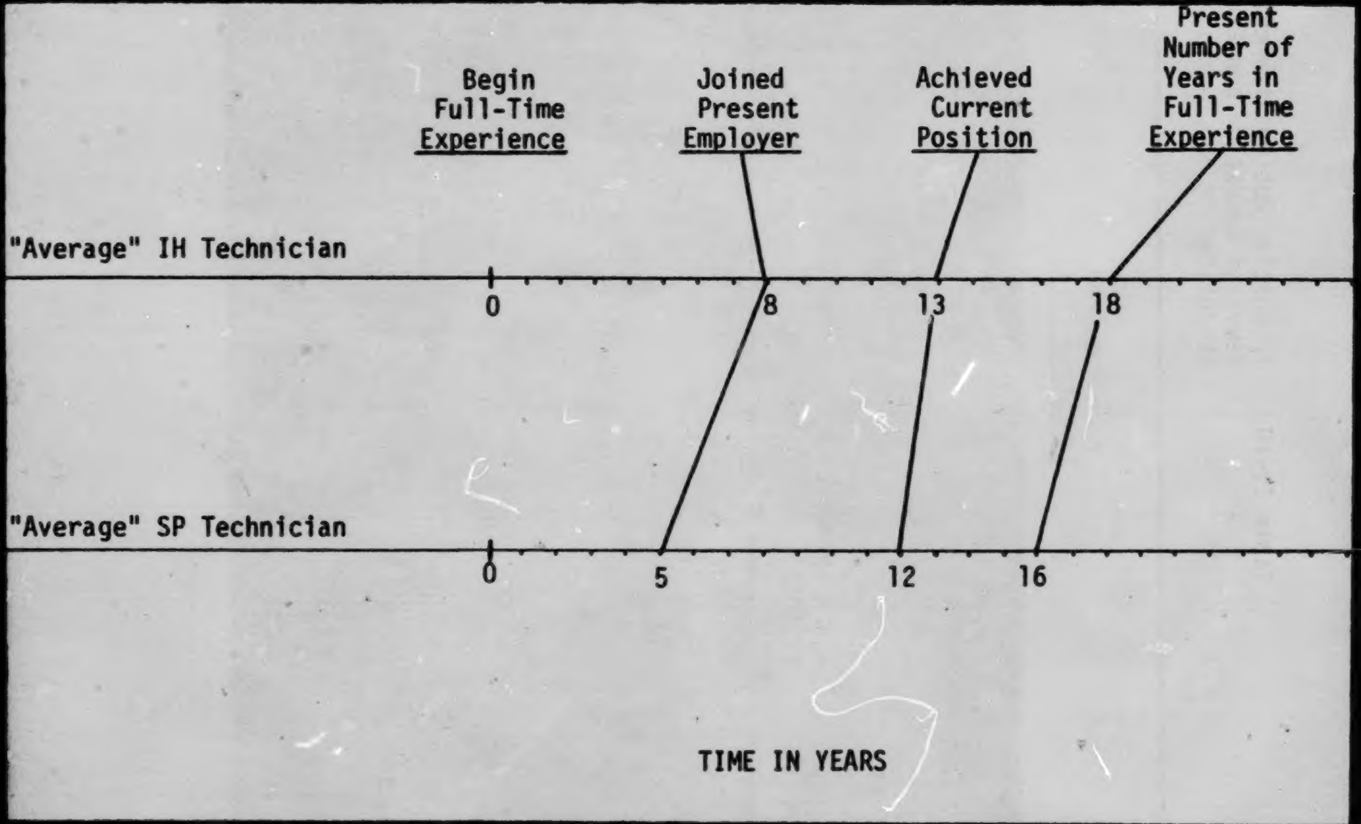
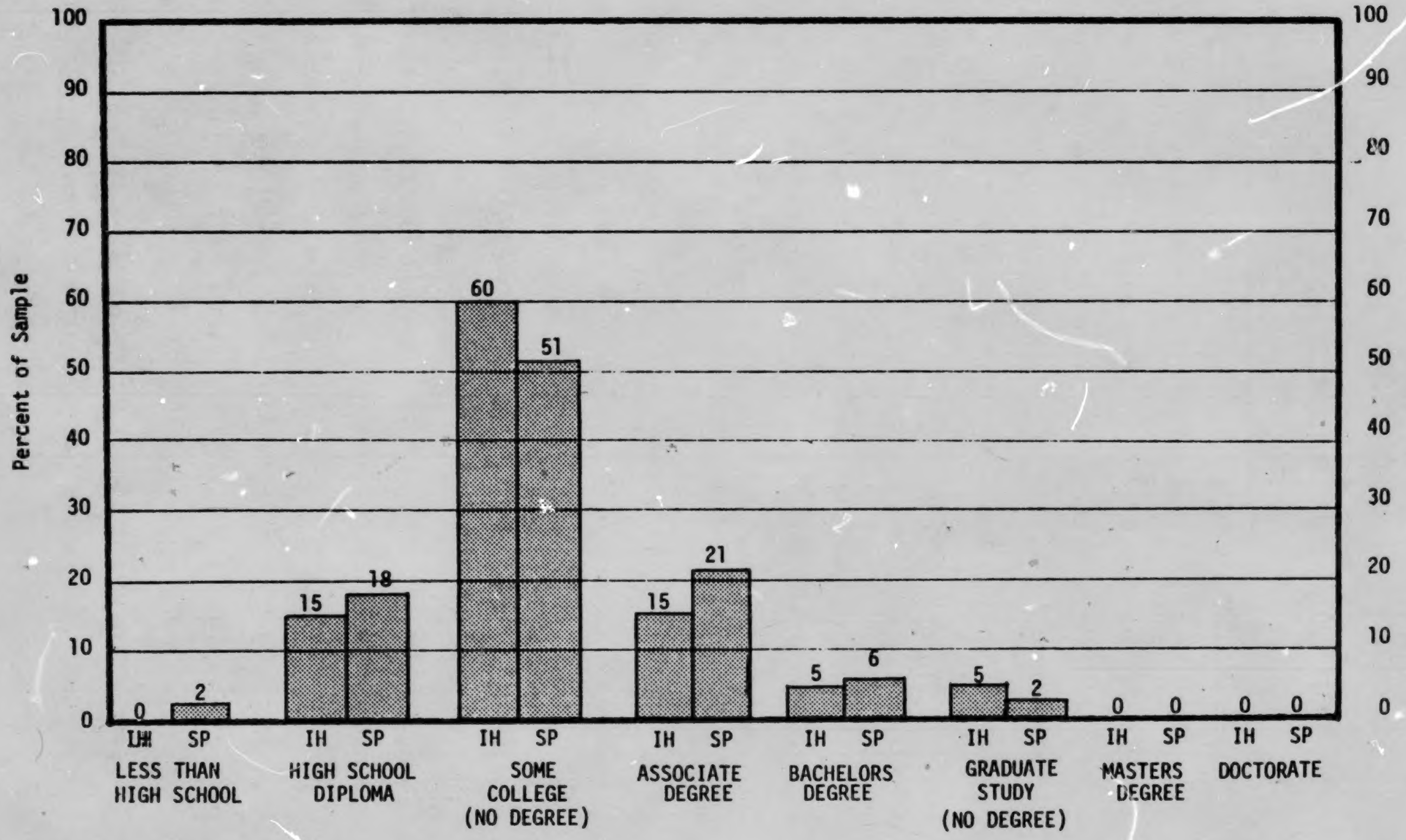


Figure IV-4. Technician Job Requirements: Profile of Highest Academic Level Achieved by Incumbent Personnel Sampled



Knowledge, Skill, and Job Requirements Composite for the *Industrial Hygiene* In Training, Professional, and Administrator and the *Safety Professional* In Training, Professional, and Administrator -

Knowledge Requirements - Figure IV-5 presents a profile of the major areas of academic study reported by the Incumbent personnel. It is seen from this Figure that the predominant field of knowledge for both occupational categories is Engineering, with Basic Science and Industrial Hygiene following. The prerequisite knowledge data presented in Table II-12 of Chapter II gives more detail for the academic knowledge requirements which the Expert Practitioners reported as being desirable for the In Training, Professional, and Administrator personnel. In general, the prerequisite knowledge data indicate that knowledge of engineering and the physical, biological and mathematical sciences are most desirable and should be primarily at the Baccalaureate level with some study at the Graduate level.

Skill Requirements - Figures IV-6 and IV-7 present the profiles of the Incumbent IH In Training, Professional, and Administrator personnel and the corresponding SP personnel, respectively, indicating the percent of time allocated to selected activities. From these profiles it is seen that the In Training, Professional, and Administrator personnel of both Professional categories are involved in the broad range of activities including identification, measurement, analysis of hazards and in program planning. A detailed view of the skills required of the IH and SP personnel may be determined by noting the tasks/activities listed in Appendix II of Technical Report IV-A.

Job Requirements - Table IV-11 presents the job requirements of years of education and experience stipulated in the job descriptions provided by Contact Persons. There were no significant differences between the *Industrial Hygiene* and the *Safety Professional* categories in either years of education (17 to 18) or years of experience (7 to 8) required in the job descriptions. Figure IV-8

Figure IV-5. In-Training, Professional, and Administrator Knowledge Requirements: Profile of Major Areas of Academic Study by Sampled Incumbents

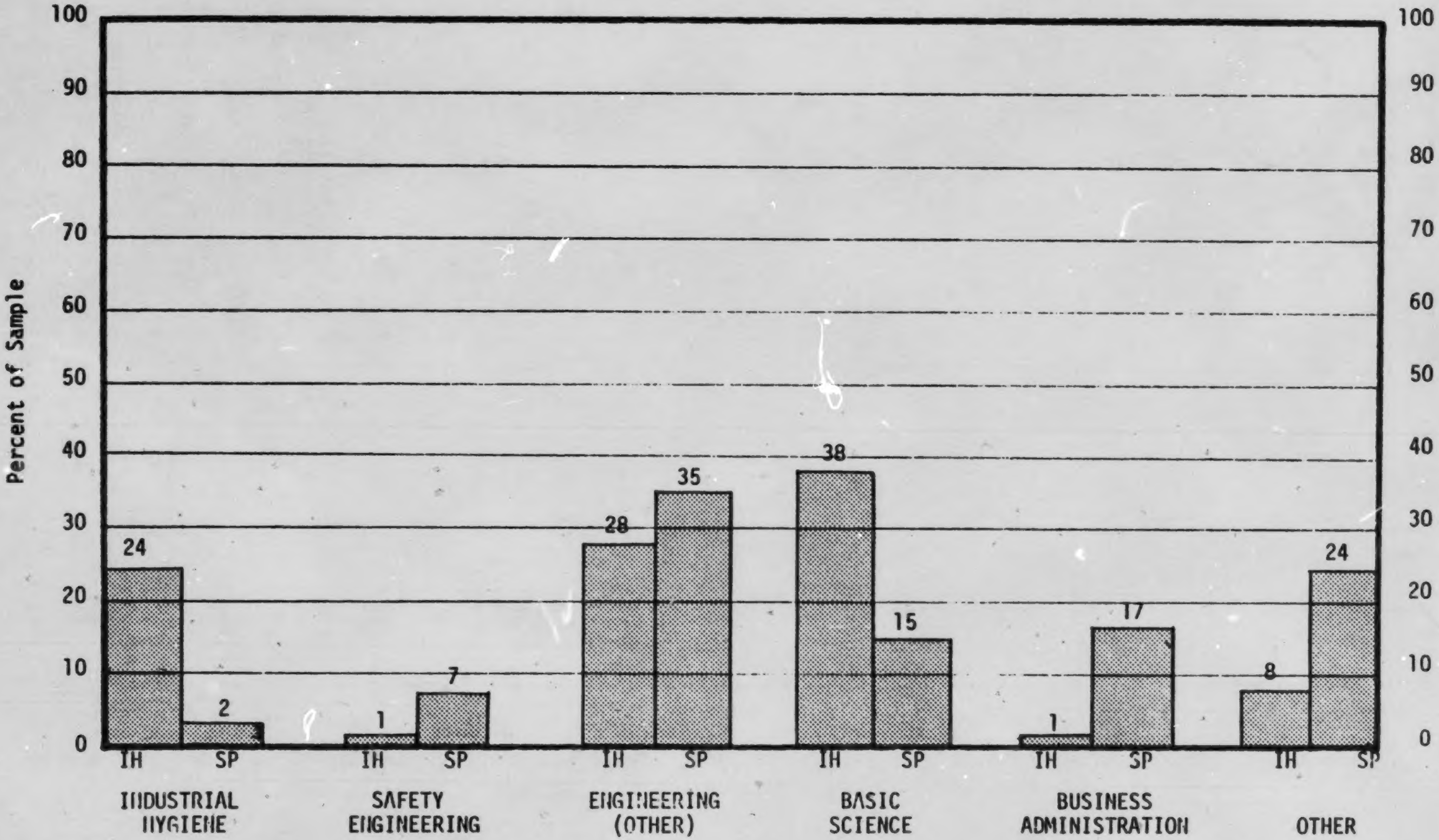


Figure IV-6. Industrial Hygiene In-Training, Professional, and Administrator Skill Requirements: Profile of Percent of Time (T) Allocated by Sampled Incumbents to Selected Activities

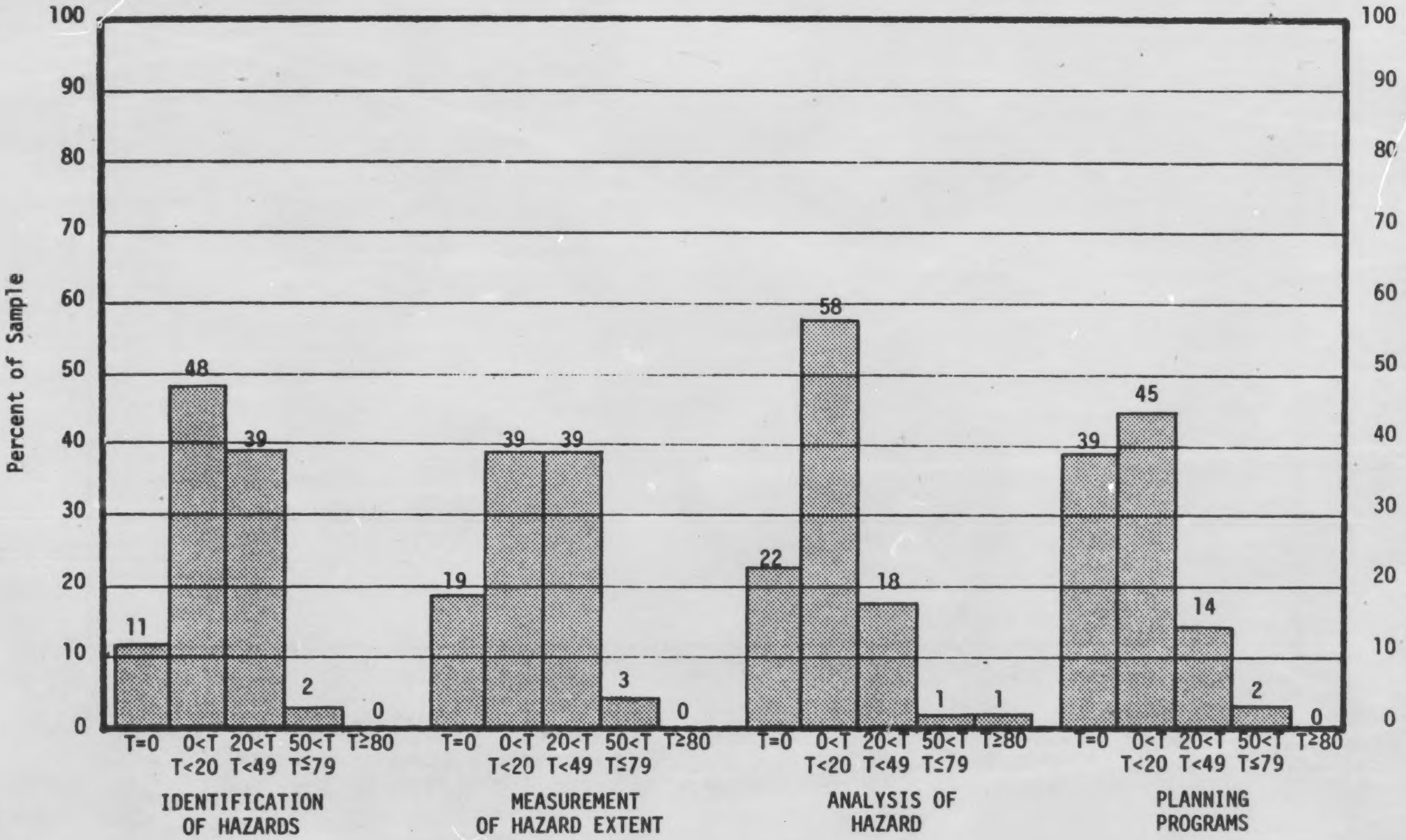


Figure IV-7. Safety Professional In-Training, Professional, and Administrator Skill Requirements: Profile of Percent of Time (T) Allocated by Sampled Incumbents to Selected Activities

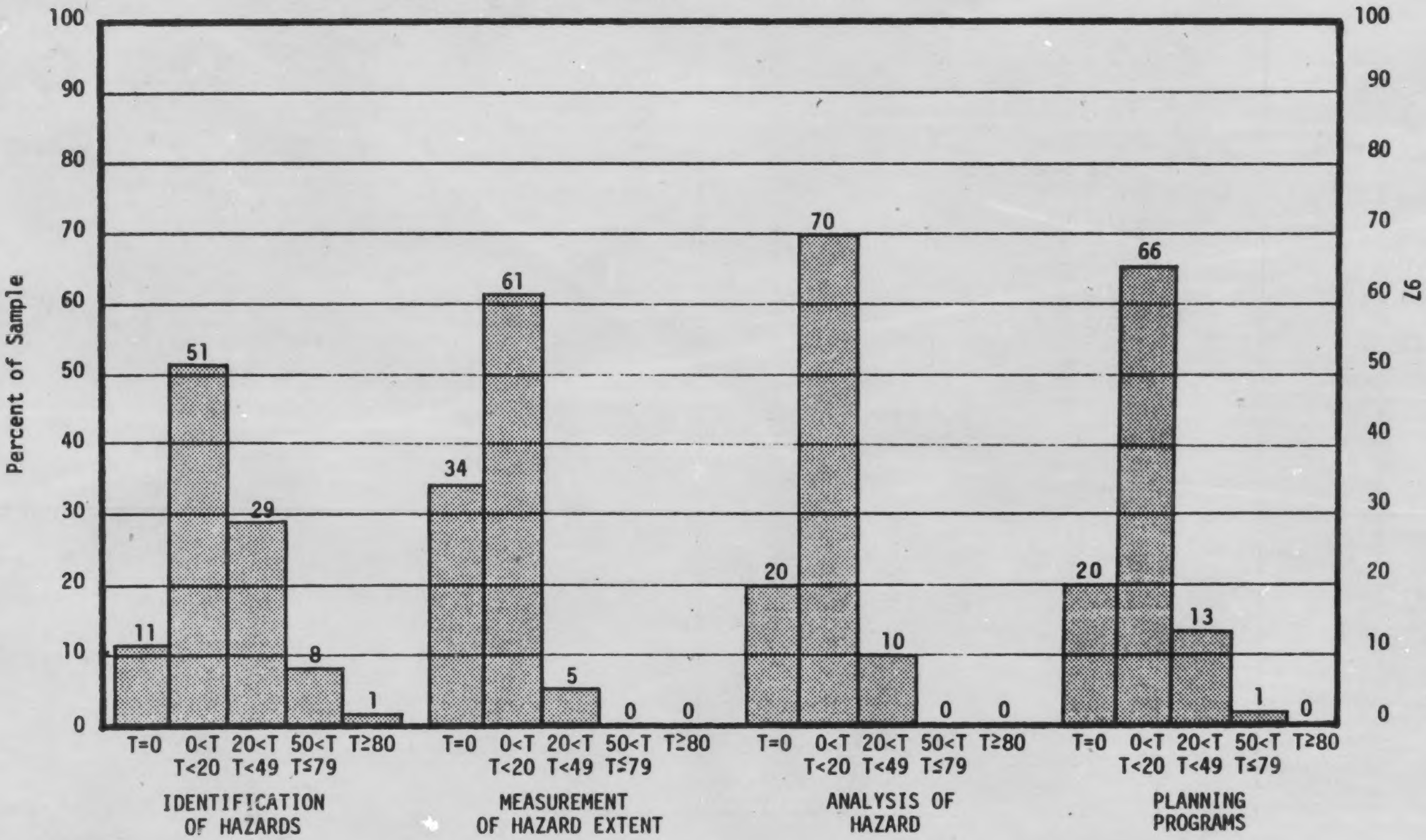


Table IV-11. In-Training, Professional, and Administrator Job Requirements: Years of Education and Experience Stipulated in Job Descriptions

	Mean Required Education (Yrs)*	Mean Required Experience (Yrs)*
Safety Professional	17.5	7.0
Industrial Hygiene	17.8	8.4

*means connected by a common line are not significantly different ($\alpha = .05$)

presents a chronological view of the mean experience data reported by the Incumbent In Training, Professional, and Administrator personnel. The Incumbent personnel also indicated their job requirements by reporting their highest academic level achieved. A profile of this data is presented in Figure IV-9. There are some differences between the two occupational categories (e.g., a greater percentage of the IH personnel had Masters degrees), but the academic level for both was predominantly from a Bachelors degree to a Masters degree.

DISCUSSION (In Training, Professional, Administrator)

From these data it is seen that the IH and SP In Training, Professional, and Administrator personnel have much in common with regard to their experience, skills and knowledge requirements. Both require approximately 7 to 8 years of experience to attain these occupational levels, both perform a broad range of tasks/activities including identification, measurement, and analysis of hazards and program planning, and both generally require knowledge of engineering and the sciences at the Baccalaureate level with some graduate study.

Although a great mass of data has been collected regarding the job requirements of occupational safety and health personnel, it is strongly emphasized that this information represents only the responses of representatives of industry, both Expert Practitioners and Incumbents, as required by the contract. No conclusions may be drawn from these data regarding the IH and SP functions within government organizations.

SUMMARY

Data gathered from Expert Practitioners, Incumbent personnel, and Industry job descriptions regarding the experience, skills, and knowledge required to perform in the *Industrial Hygiene* and *Safety Professional* Technician, In Training, Professional, and Administrator occupational levels were correlated, merged, and consolidated.

Figure IV-8. In-Training, Professional, and Administrator Job Requirements: Calendar of Experience for the "Average" Incumbent Sampled

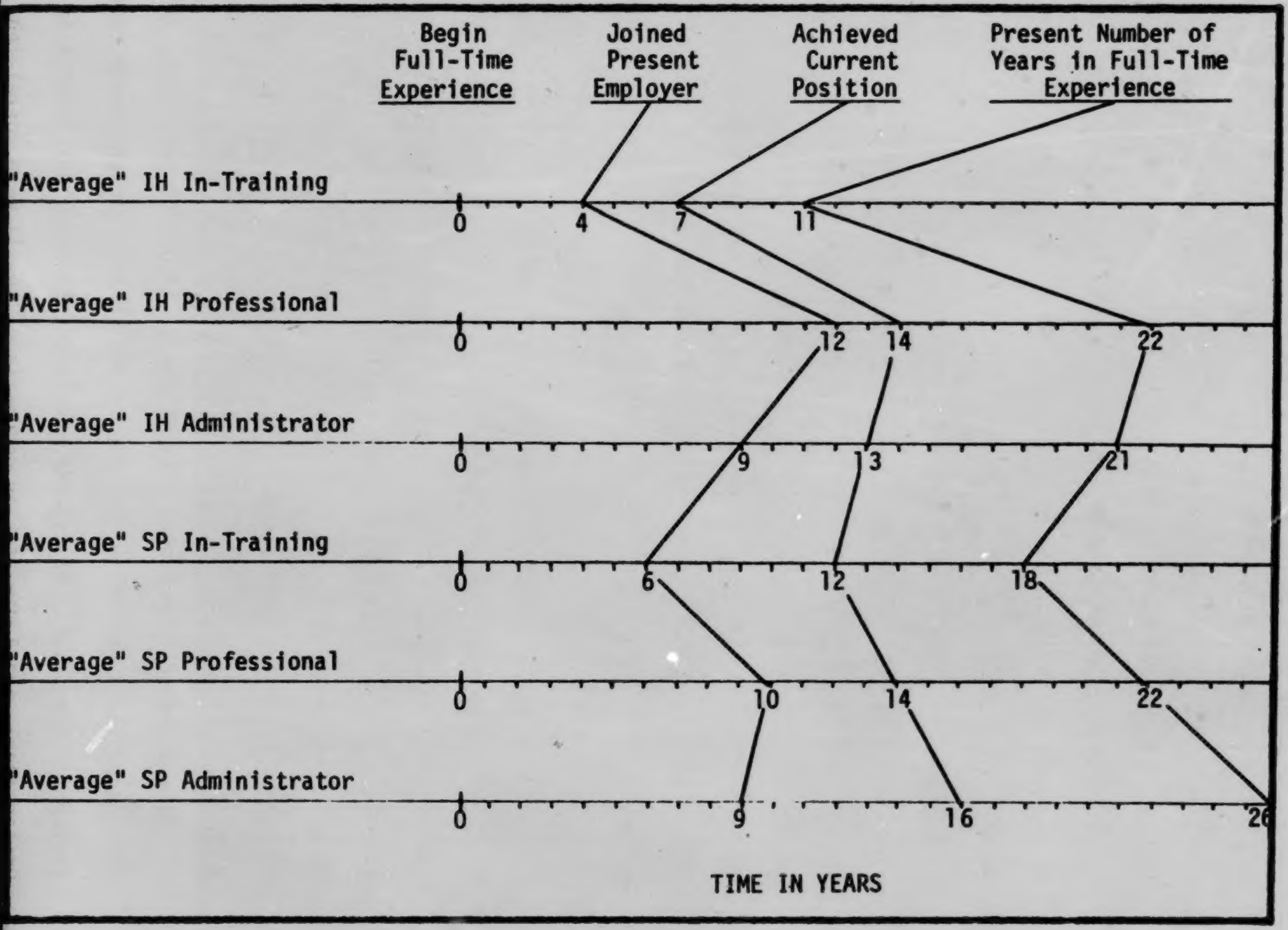
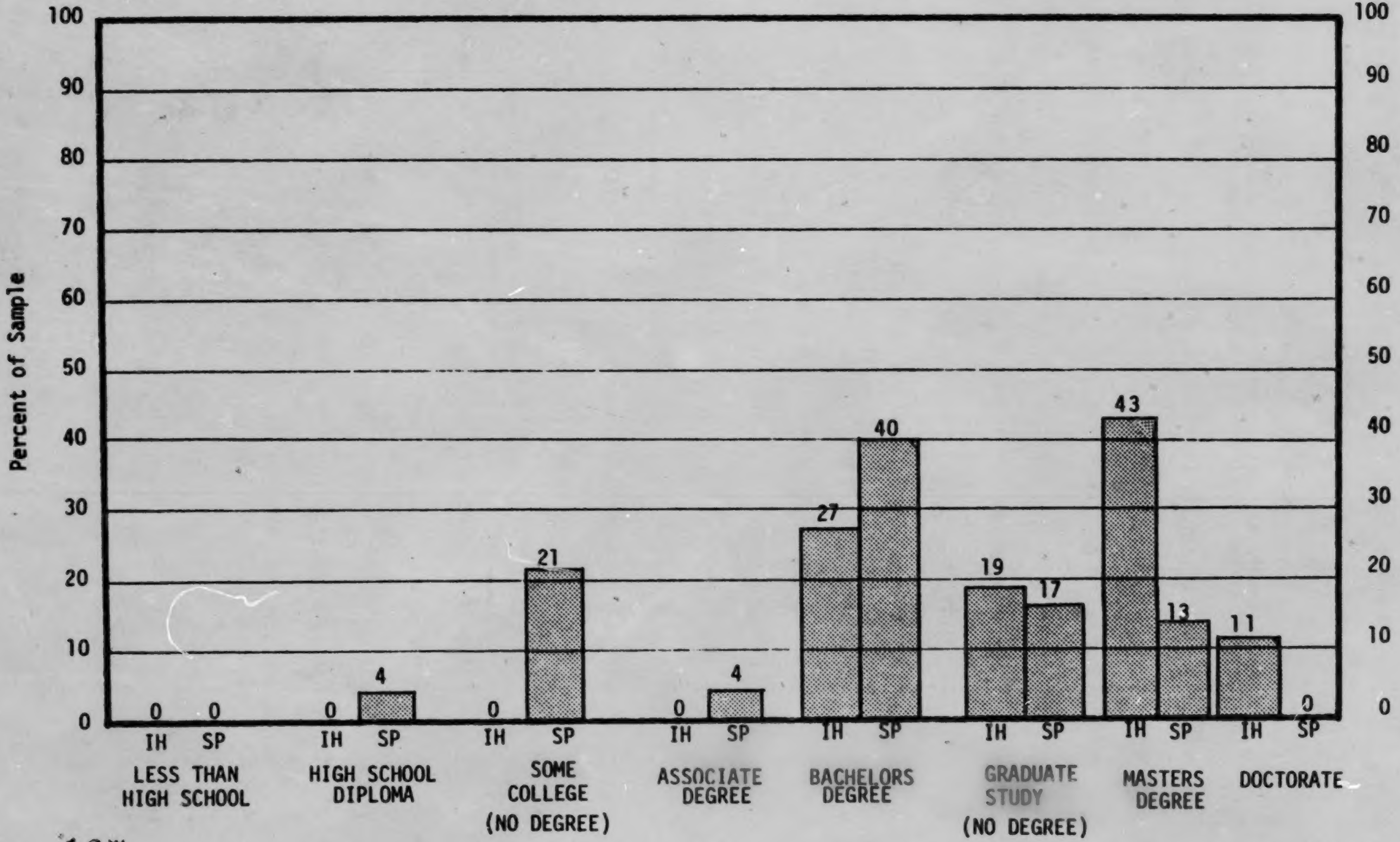


Figure IV-9. In-Training, Professional, and Administrator Job Requirements: Profile of Highest Academic Level Achieved by Incumbent Personnel Sampled



Comparisons were made between the task/activity responses made by the Expert Practitioner group and the responses made by the Incumbent personnel at two criterion levels of performance (1/3 and 1/2). The one-third criterion includes all tasks/activities in which greater than 33 percent of the Incumbent personnel indicated them as being performed; the one-half criterion includes all tasks/activities in which greater than 50 percent of the Incumbent personnel indicated them as being performed.

The contingency correlation analyses performed indicated:

(1) there is a significant association between the responses made by the Expert Practitioners and those made by the Incumbents.

(2) the contingency coefficients were slightly higher (indicating slightly better association between the sets of responses) when the criterion level of performance used was 1/3, and

(3) there is a relatively large number of tasks/activities of the total 753 which both the Expert Practitioner group and the Incumbent personnel indicated as being "performed" (73 percent of the 753 tasks/activities); the number decreases as the criterion level of performance used with the Incumbent data increases (i.e., from 1/3 to 1/2).

Profiles were developed to illustrate the experience, skills, and knowledge requirements for IH and SP Technician, In Training, Professional, and Administrator personnel.

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CHAPTER V

CERTIFICATION REQUIREMENTS AND METHODS

Objective V.

To study present certification requirements and methods for individuals employed in the Industrial Hygiene and Safety Professional occupations and to make recommendations, based upon the results of the project, which may be used to modify the certifying procedures used by the certifying Boards.

The current published certification criterion published by the American Board of Industrial Hygiene and the Board of Certified Safety Professionals were secured, studied and published in Technical Reports V and IX.

Results stemming from the task/activity analysis data collected from the Expert Practitioners and the Incumbent personnel (Technical Reports III, IV and IV-A) were used to evaluate current certification requirements and methods for certification as published by the two Boards. The criterion were studied from the viewpoint of certification for the eight occupational levels defined in this project; Industrial Hygiene Technician, Industrial Hygiene in Training, Industrial Hygiene Professional, Industrial Hygiene Administrator and Safety Professional Technician, Safety Professional In Training, Safety Professional, Safety Professional Administrator.

Certification of Technicians -

Neither the American Board of Industrial Hygiene (ABIH) nor the Board of Certified Safety Professionals (BCSP) currently have certification criteria for "technicians." The ABIH has recently developed (since the initiation of this project) certification procedures for Industrial Hygiene Technologists. An Industrial Hygiene Technologist is defined as "... a person who, by virtue of studies and training, has acquired proficiency in an aspect or phase of industrial hygiene, e.g., air sampling, monitoring, instrumentation, specialized laboratory procedures, and who performs such duties under the supervision of an industrial hygienist."

Complete information pertaining to certification of Industrial Hygiene Technologists is available from

The American Board of Industrial Hygiene
66 South Miller Road
Akron, Ohio 44313

Since the specific experience and education requirements for Industrial Hygiene Technologists are pertinent to this project, they are summarized. An applicant must possess five years of experience in industrial hygiene under the direction of a Certified Industrial Hygienist subsequent to receipt of a high school diploma. An associate degree from an accredited institution in engineering, industrial hygiene or environmental sciences may be accepted by the ABIH as equivalent to two years of experience. By interpretation, it is apparent that three years of acceptable experience plus an approved associate degree would be acceptable to the ABIH for the combined experience/education of an applicant. Provision is also made for an applicant with two years of education in an accredited college or university with satisfactory completion of introductory courses in chemistry, physics, biology and mathematics to be granted the equivalent of one year of experience by the ABIH. Thus, it is apparent that an applicant with acceptable academic exposures and four years of approved experience would be an eligible applicant for the ABIH Industrial Hygiene Technologist's examination.

As indicated earlier, the BCSP does not have certification requirements for Safety Professional Technicians.

Certification of Professional Levels -

Both the American Board of Industrial Hygiene and the Board of Certified Safety Professionals have certification criteria for the professional level. Data pertaining to the ABIH examination qualifications and processes are available from

The American Board of Industrial Hygiene
66 South Miller Road
Akron, Ohio 44313

Information and criteria for BCSP certification is available from

The Board of Certified Safety Professionals
501 South Sixth Street
Champaign, Illinois 61820

The experience and education requirements to qualify for the ABIH and the BCSP examinations are summarized separately.

The ABIH issues three categories of certification.

1. Industrial Hygiene Technologists -- (based on experience, education and technical ability as described in Certification of Technicians above).
2. Industrial Hygienists In Training -- Certification is in recognition of special education in the knowledge of the basic principles of industrial hygiene.
3. Industrial Hygienists -- This certification is in recognition of special education, experience, and proven professional ability in

the comprehensive practice of industrial hygiene or in the application of a specialized aspect of industrial hygiene; acoustical, air pollution, chemical, engineering, radiological, and toxicological.

In the ABIH, certification as an Industrial Hygienist In Training would be expected to precede certification as an Industrial Hygienist. In some instances, this may not be true because an applicant meeting all requirements may qualify to complete the ABIH examination process in two consecutive days and be certified as an Industrial Hygienist, thus by-passing the Industrial Hygienist In Training designation.

The minimum education requirement for the Industrial Hygienist In Training certification is "graduation from a college acceptable to the Board with a baccalaureate degree in industrial hygiene, chemistry, physics, chemical, mechanical, or sanitary engineering, biology, or other acceptable major subject."

Minimum experience requirements are "at least one year of full-time practice of industrial hygiene acceptable to the Board, under close supervision of an Industrial Hygienist, subsequent to the baccalaureate degree. Full time graduate study may be accepted as equivalent to one year of experience provided that major graduate study is in a specialty of Industrial Hygiene and the applicant has earned a master's degree. The applicant must be in the full time practice of Industrial Hygiene at the time of the examination."

The ABIH educational requirements for certification as an Industrial Hygienist are identical to those stated for the Industrial Hygienist In Training. Experience requirements, however, differ and they are quoted from the ABIH Bulletin.

> Five years of practice of industrial hygiene acceptable to the Board, subsequent to the baccalaureate degree.
>
> (1) A candidate for certification in the comprehensive practice of industrial hygiene is expected by the Board to perform most, if not all, of the functions listed in the ... "Functions of the Industrial Hygienist." For the experience time claimed as industrial hygiene practice the candidate must have spent at least 50% of his/her time in industrial hygiene activities.
>
> (2) In the case of applications for certification in a specialized aspect of industrial hygiene, the applicant must have spent more than 25% of his/her time in every year for which experience is claimed in the application of that specialty discipline to the purposes of industrial hygiene.
>
> (3) Practice also includes teaching, research, or professional administration of industrial hygiene activities.
>
> (4) Graduate degrees may be accepted as equivalent to part of the required period of practice. Up to two years may be claimed on the basis of a maximum of one year for a master's degree(s) and an additional one year maximum for a doctor's degree(s), provided that each graduate degree is in a cognate discipline ....
>
> The applicant must be engaged in the practice of industrial hygiene at the time the application is submitted.

The ABIH also provides the opportunity for nondegree individuals to qualify for examination. The nondegree person may, as a result of long experience, special training and demonstrated professional responsibility in Industrial Hygiene, be qualified for certification.

The foregoing education and experience requirements are minimum criteria established by the ABIH and must be met to acquire eligibility to take the respective ABIH examination.

The BCSP currently issues only one level of certification, Certified Safety Professional. However, the BCSP is currently considering certification procedures for Associate Safety Professionals and certain specialty certification including engineering aspects, management aspects and comprehensive. Therefore, the BCSP certification process will apparently be altered to provide an "associate" or "in training" designation followed by certified professional designations, i.e., "Certified Safety Professional--Engineering Aspects."

Minimum education requirements established by the BCSP are "A graduate of an accredited college or university with a Baccalaureate degree in the physical sciences, engineering, or other curricula acceptable to the Board. Although full credit is not allowed for curricula which are limited in the study of the physical sciences and mathematics, each applicant's formal education will be evaluated individually to determine the amount of credit acceptable to the Board."

An applicant who does not meet the academic requirements stated above may be permitted to substitute two years of acceptable safety experience for each academic year needed by the applicant to satisfy the academic requirements.

The BCSP minimum requirement for experience is five years or more of professional safety experience, i.e., "work of progressive importance and achievement which indicates an ability to apply successfully a significant portion of the expertise required of a Certified Safety Professional."

The expertise is further defined, "to create or develop procedures, processes, standards, specifications and systems to achieve an optimal control or reduction of the hazards and exposures which are detrimental to people and/or property by the utilization of analysis, synthesis, investigation, evaluation, research, planning, design, and consultation."

These minimum education and experience requirements are established by the BCSP and must be met to be eligible for the BCSP examination.

One of the basic premises of this Project has been that there are four distinct occupational levels within the *Industrial Hygiene* (IH) and the *Safety Professional* (SP) categories, namely

IH Technician	SP Technician
IH In Training	SP In Training
IH Professional	SP Professional
IH Administrator	SP Administrator

The data in Technical Report III, as provided by Expert Practitioners and analyzed by (1) tasks/activities, (2) occupational levels, and (3) functional levels indicates that differences do exist, for example, between the IH Technician and the other *Industrial Hygiene* occupational levels and between the SP Technician and the other *Safety Professional* occupational levels. However, from a functional viewpoint, levels of performance can be more completely described by some combination of occupational levels, for example, IH Technician and IH In Training.

The incumbent data reported in Technical Reports IV and IV-A identify the tasks/activities performed by IH Technicians and SP Technicians, as well as other occupational levels, by functional levels. Although the technician level incumbents, both Industrial Hygiene and Safety Professional, do perform "Control of Exposure" type functions, it is evident that these "control" tasks/activities are not performed as frequently by the technician occupational levels as they are at other occupational levels, for example, IH Professional and SP Professional.

METHOD (TECHNICIANS)

Specific criteria and additional data were developed to list the tasks/activities that are "performed" by the technicians. The assignments made by the Expert Practitioners, the responses of the Incumbents, and the academic levels assigned by the Advisory Committee and the Expert Practitioners were used to establish the list of "performed" tasks/activities. The academic level assignments were made in conference by five-member groups who utilized both individual tasks/activities and the performance objectives for each task/activity in making their decisions. Each task/activity with its corresponding performance objective was randomly assigned to one of seven five-member groups composed of representatives of the Advisory Committee and the Expert Practitioners. Both the Advisory Committee and the Expert Practitioner groups were composed of individual Industrial Hygienists and Safety Professionals and each of the groups had Industrial Hygiene and Safety Professional representation.

To assist in assigning the tasks/activities five Priority Categories were established. These Priority Categories are summarized in Table V-1.

RESULTS

A listing that may be used in determining tasks/activities that could form a part of certifying examinations for technicians or which may provide a meaningful measure of any existing examination that is based on knowledge inherent in tasks/activities in the *Industrial Hygiene* and *Safety Professional* categories was developed using the Priority Categories shown in Table V-1. The detailed listing is given in Technical Report V. These data show considerable agreement in the Priority Category A tasks/activities. In Priority Categories C, D, and E there is some disagreement between the Expert Practitioner and incumbent data. It is evident in the "C" tasks/activities that Expert Practitioners indicated that 52 tasks/activities should be performed by IH Technicians while the Incumbents indicated that they were not performing these tasks/activities. The Expert Practitioners also indicated that 29 of the "C" tasks/activities should be assigned to SP Technicians while Incumbents indicated that they did not perform those tasks/activities.

Table V-1. Summary of Technician Tasks/Activities Assigned to Priority Categories A, B, C, D, or E

PRIORITY CATEGORIES	NUMBER OF TASKS/ACTIVITIES ASSIGNED TO INDUSTRIAL HYGIENE TECHNICIANS	NUMBER OF TASKS/ACTIVITIES ASSIGNED TO SAFETY PROFESSIONAL TECHNICIANS	NUMBER OF TASKS/ACTIVITIES ASSIGNED TO BOTH INDUSTRIAL HYGIENE TECHNICIANS AND SAFETY PROFESSIONAL TECHNICIANS
A	34	38	15
B	5	20	5
C	52	29	14
D	0	33	0
E	32	11	7

PRIORITY CATEGORIES:

A. Task/activity assigned as "performed by Technicians" by the Expert Practitioners, indicated as "performed" by at least 1/3 of the incumbents, and with Associate-level academic assignment.

B. Task/activity assigned as "performed by Technicians" by the Expert Practitioners, indicated as "performed" by at least 1/3 of the incumbents, and with Associate-level or Baccalaureate level academic assignment.

C. Task/activity assigned as "performed by Technicians" by the Expert Practitioners, indicated as "not performed" by at least 1/3 of the incumbents, and with Associate-level or Baccalaureate level academic assignment.

D. Task/activity assigned as "not performed by Technicians" by the Expert Practitioners, indicated as "performed" by 1/2 of the incumbents, and with Associate-level or Baccalaureate-level academic assignment or unassigned.

E. Task/activity assigned as "performed by Technicians" by the Expert Practitioners, indicated as "not performed" by incumbents, and no academic-level assignment.

The Priority Category D assignments suggest that Incumbents classified as SP Technicians are performing tasks/activities which the Expert Practitioners believed should be assigned to other occupational levels. The tasks/activities in Priority Category D were indicated as "performed" by at least 50 percent of the Incumbents in the SP Technician classification.

The Priority Category E assignments indicate that the Expert Practitioners believed the IH Technician and the SP Technician occupational levels should be performing some tasks/activities which were indicated as "not performed" by the corresponding Incumbents.

Table V-2 is a summary of the tasks/activities by Priority Category and Type of Exposure which are "performed" by the IH Technicians and the SP Technicians. The majority of the tasks/activities in the Priority Categories A and B performed by the IH Technician fall into the Air Quality and Physical Exposures with some emphasis in Hazardous Materials and Flammable Materials.

It is also true that the SP Technician performs tasks/activities in these areas but not as many as the IH Technician. In the two Priority Categories (A and B) for the four Types of Exposures (Air Quality, Physical Exposures, Hazardous Materials, Flammable Materials), the two technician groups perform 18 of the same tasks/activities.

It is noted that for the Priority Category C tasks/activities (i.e., those which the Expert Practitioners believed should be performed by technicians) the Incumbent IH Technicians did not perform 52 of them. The Incumbent SP Technicians did not perform 28 of the tasks/activities indicated to be within their scope of performance by the Expert Practitioners.

In Priority Category D, at least one-half of the Incumbent SP Technicians indicated they were performing these thirty-three tasks/activities. The Expert Practitioners assigned these to one of the other occupational levels.

In Priority Category E (i.e., tasks/activities indicated as "not performed" by the Incumbent technician) 32 tasks/activities indicated as "not performed" by the IH Technicians and 11 as "not performed" by the SP Technicians were assigned as "performed" at the technician level by the Expert Practitioners.

DISCUSSION

The conclusions which may be drawn from these data are as follows:

1. The concept of "occupational levels" is more apparent within the *Industrial Hygiene* category than within the *Safety Professional* category, i.e., the occupational levels appear to be more distinct in the *Industrial Hygiene* category, including IH Technician.
2. When considering tasks/activities that are functionally classified as "Control of Exposures," the distinctions between occupational levels are more apparent in both the *Industrial Hygiene* and the *Safety Professional* categories. Specifically, these results support the conclusions developed from the Expert Practitioner data which indicated that "Control of Exposure" tasks/activities are more related to the In Training, Professional and Administrator occupational levels than to the Technician occupational level.

Table V-2. Summary of Number of Tasks/Activities Performed by IH Technicians and SP Technicians by Priority Category and Type of Exposure

		TYPE OF EXPOSURE									
PRIORITY CATEGORY	TECH. CLASS.	GENERAL	AIR QUALITY	PHYSICAL EXPOSURES	HAZARDOUS MATERIALS	FLAMMABLE MATERIALS	MATERIALS HANDLING	MECHANICAL/ ELECTRICAL	FACILITIES	TRAINING	TOTAL
A	IH	3	20	8	2	1	---	---	-	-	34
	SP	5	5	7	5	4	4	3	3	2	38
	IH/SP	1	6	4	2	1	---	---	-	-	14
B	IH	-	2	1	1	1	---	---	-	-	5
	SP	2	2	2	1	2	2	2	2	5	20
	IH/SP	-	2	1	1	1	---	---	-	-	5
C	IH	1	17	23	1	2	2	1	1	4	52
	SP	1	11	11	-	-	2	1	1	1	28
	IH/SP	-	4	10	-	-	---	---	-	-	14
D	IH	-	--	--	-	-	---	---	-	-	--
	SP	9	--	--	3	4	6	3	6	2	33
	IH/SP	-	--	--	-	-	---	---	-	-	--
E	IH	1	8	15	1	2	4	1	-	-	32
	SP	-	--	3	1	2	1	1	1	2	11
	IH/SP	1	--	2	1	2	1	1	-	-	7

PRIORITY CATEGORIES:

A. Task/activity assigned as "performed by Technicians" by the Expert Practitioners, indicated as "performed" by at least 1/3 of the incumbents, and with Associate-level academic assignment.

B. Task/activity assigned as "performed by Technicians" by the Expert Practitioners, indicated as "performed" by at least 1/3 of the incumbents, and with Associate-level or Baccalaureate-level academic assignment.

C. Task/activity assigned as "performed by Technicians" by the Expert Practitioners, indicated as "not performed" by the incumbents, and with Associate-level or Baccalaureate-level academic assignment.

D. Task/activity assigned as "not performed by Technicians" by the Expert Practitioners, indicated as "performed" by 1/2 of the incumbents, and with Associate-level or Baccalaureate-level academic assignment or unassigned.

E. Task/activity assigned as "performed by Technicians" by the Expert Practitioners, indicated as "not performed" by incumbents, and no academic-level assignment.

3. While significant differences between technician levels and other occupational levels are not as great as one may have expected, tasks/activities performed by IH Technicians and SP Technicians can be identified. Using Priority Categories A and B, 39 tasks/activities were identified as performed by the IH Technician and 58 as performed by the SP Technician. Priority Category E identified 32 additional IH Technician tasks/activities that should be performed as well as 11 SP Technician tasks/activities that should be performed. Priority Category C identified 78 additional tasks/activities that should be performed at the technician occupational level; 50 by IH Technicians and 28 by SP Technicians.
4. There were 33 tasks/activities which the Incumbent Technicians indicated as being performed which the Expert Practitioners indicated as "not performed" at the Technician level.

Based on these data it is inappropriate to propose methods and requirements for certification of Industrial Hygiene and Safety Professional Technicians. It becomes apparent that Industrial Hygiene Technicians and Safety Professional Technicians are often performing identical tasks/activities. It is also evident that both technician occupational levels are not performing all of the tasks/activities that should be assigned to them (according to Expert Practitioner opinions). Insofar as the Safety Professional Technicians are concerned, some tasks/activities performed by them should be performed at other occupational levels. Therefore, alternate methods and requirements for certification of Industrial Hygiene and Safety Professional Technicians have not been developed. However, academic programs for both IH Technicians and

SP Technicians are suggested in Chapter VII. These programs could be used as the base for the development of "certificate programs" for these two occupational levels or the programs could be combined to prepare an "Occupational Health and Safety Technician" with certification an ultimate result. This concept is discussed in detail in Technical Report V, Certification Requirements and Methods for Industrial Hygiene Technicians and Safety Professional Technicians.

PROCEDURES (IN TRAINING, PROFESSIONAL, ADMINISTRATOR)

Specific criteria and additional data were developed to list the tasks/activities that are "performed" by the IH and SP In Training, Professional, and Administrator personnel. The assignments made by the Expert Practitioners, the responses of the Incumbents, and the academic levels assigned by the Advisory Committee and the Expert Practitioners were used to establish the list of "performed" tasks/activities.

The academic level assignments were made in conference by five-member groups who utilized both individual tasks/activities and the performance objectives for each task/activity in making their decision. Each task/activity with its corresponding performance objective was randomly assigned to one of seven five-member groups composed of representatives of the Advisory Committee and the Expert Practitioners. Both the Advisory Committee and the Expert Practitioner groups were composed of individual Industrial Hygienists and Safety Professionals and each of the groups had Industrial Hygiene and Safety Professional representation.

To assist in clarification of the assignments made by the Expert Practitioners (i.e., the occupational level within a professional category) and the performance of the Indumbents (i.e., the occupational level wtihin a professional category), a scheme was evolved to group these two sets of data. Specific criteria were developed for *Industrial Hygiene* and for *Safety Professional* categories; designated as M, N, O, and Y and R, S, T, and Z, respectively. For example, the specific criteria for category M is

1. A task/activity assigned by the Expert Practitioners as "performed" at the IH In Training, In Training-Professional, and In Training, Professional, Administrator levels and given the functional assignment of (B) Acquisition of Data/Measurement of Exposures and/or (C) Analysis of Data/Evaluation of Measurement Results and/or (D) Control of Exposures (reference Technical Report III).
2. At least one-third of the Incumbents classified as IH In Training, IH Professional, or IH Administrator performed the task/activity (reference Technical Report IV and IV-A).
3. A task/activity which received a baccalaureate or graduate level academic assignment by the Advisory Committee/Expert Practitioner groups.

These specific criteria for each category are summed in Table V-3 and the complete procedure is detailed in Technical Report IX. The functional levels (A, B, C, and D) are defined in Chapter II, page 31.

RESULTS

A listing that may be used in determining tasks/activities that could form a part of certifying examinations for *Industrial Hygiene* or *Safety Professional* categories or which may provide a meaningful measure of any existing examination that is based on knowledge inherent in tasks/activities

Table V-3. Number of Tasks/Activities (T/A) Assigned as "Performed" by Expert Practitioners (EP) and Actually Performed by Industrial Hygiene and Safety Professional Incumbents Within Specific Criteria

Professional Categories	NUMBER OF TASKS/ACTIVITIES PERFORMED WITH SPECIFIC CRITERIA							
	M	N	O	Y	R	S	T	Z
Industrial Hygiene	45	26	6	46	39	18	6	--
Safety Professional	39	18	6	--	63	35	8	23

Specific Criteria:

M. Assigned as "performed" by EP to IH In Training, Professional and Administrator levels; B, C, and D functions; 1/3 of Incumbent IH In Training, Professional, and Administrator "performed" T/A; BS or MS academic assignment.

N. Assigned as "performed" by EP to IH Professional level; C and D functions 1/2 of Incumbent IH Professionals "performed" T/A; BS or MS academic assignment.

O. Assigned as "performed" by EP to IH Professional and Administrator levels; C and D functions; 1/3 of Incumbent IH Professional and Administrator performed T/A; BS or MS academic assignment.

Y. Assigned as "performed" by EP to IH Technician and In Training levels; A or B functions; 1/3 of Incumbent IH Professionals performed T/A, AS or BS academic assignment.

R. Assigned as "performed" by EP to SP In Training, Professional and Administrator levels; B, C, and D functions; 1/3 of SP In Training, Professional, and Administrator performed T/A; BS or MS academic assignment.

S. Assigned as "performed" by EP to SP Professional level; C and D functions; 1/2 of Incumbent SP Professionals performed T/A, BS or MS academic assignment.

T. Assigned as "performed" by EP to SP Professional and Administrator levels; C and D functions; 1/3 of Incumbent SP Professional and Administrator performed T/A; BS or MS academic assignment.

Z. Assigned as "performed" by EP to SP Technician and In Training levels; A and B functions; 1/3 of Incumbent SP Professional performed T/A; AS or BS academic assignment.

in the *Industrial Hygiene* and *Safety Professional* categories was developed using the categories (M, N, O, Y, R, S, T, Z) previously defined. The detailed listing is presented in Technical Report IX.

Industrial Hygiene -

Summarizing the results of Technical Report IX, when all of the IH Administrator, IH Professional, and IH In Training occupational levels and the Class B, C, and D functional levels were evaluated it was found that:

1. There were no significant differences in the IH In Training, IH Professional, and IH Administrator performance levels and the Class B functional level.
2. There were no significant differences in the IH In Training, IH Professional, and IH Administrator performance levels in the Class C functional level.
3. There were no significant differences in the IH In Training and the IH Professional performance levels and the Class D functional level.
4. There was a significant difference in the IH Administrator performance level and the IH Professional and the IH In Training in the Class D functional level.

In referring to the M category in Table V-3, 45 tasks/activities were assigned to the combined occupational levels that include IH In Training, IH In Training-Professional-Administrator. Of these 45 tasks/activities, 39 (87%) were also assigned as "performed" by the SP In Training, SP In Training-Professional, and SP In Training-Professional-Administrator.

In the N category, 26 tasks/activities were assigned to the IH Professional occupational level. Note that at least one-half of the Incumbent IH Professionals performed these tasks/activities while at least one-third of the Incumbents performed the M category tasks/activities. Eighteen (69%) of the N category tasks/activities were also assigned as "performed" by the SP Professional.

The O category, Table V-3, was restricted to the tasks/activities performed by the IH Professional-Administrator and the IH Administrator occupational levels. Six tasks/activities were designated to this category and performed by at least one-third of the Industrial Hygienists; the same six tasks/activities were also performed by at least one-third of the SP Professional and SP Administrators.

Two additional categories, Y and Z, were developed to indicate the "technician" and the "technician in training" tasks/activities (in the opinion of the Expert Practitioners) that are being "performed" by Incumbent IH Professionals and SP Professionals, respectively. The Incumbent IH Professionals are performing 46 tasks/activities which the *Industrial Hygiene* Expert Practitioners believed should be performed by IH Technicians and/or IH In Training. This may be stated differently; the Incumbent IH Professionals are certified by the ABIH either in Comprehensive Practice or in one of the specialties. Their peer counterparts, the Expert Practitioner Industrial Hygienist (twelve of fifteen of these individuals are certified by ABIH) believed that the 46 tasks/activities should be assigned to IH Technician and/or IH In Training occupational levels. In Category Y, 10 of the tasks/activities were performed by at least one-third of the Incumbent IH Professionals; 5 air quality and 5 physical exposure type tasks/activities. At least one-half of the Incumbent IH Professionals performed 15 of the tasks/

activities; 7 air quality, 6 physical exposures, and 2 general tasks/activities. Twenty-one of the tasks/activities were performed by at least two-thirds of the Incumbent IH Professionals; 16 air quality, 3 physical exposures, and 2 general tasks/activities.

It is evident that one or more factors may affect the performance of these 46 tasks/activities by Incumbent IH Professionals:

1. the Expert Practitioners may have misjudged the level of assignment.
2. the educational level of the 56 Incumbent IH Professionals is not required to perform this level of tasks/activities (21 had baccalaureate degrees, 22 had master's degrees, 4 had doctorate degrees, and 9 had graduate study but with no degree). All of the Incumbent IH Professionals had at least the baccalaureate degree.
3. there is a shortage of qualified IH Technician and/or IH Technicians-In Training personnel.

It is believed that the third factor--the shortage of qualified technician and in-training personnel--is largely responsible for the dilemma; the tasks/activities must be performed and the IH Professional is the only individual qualified to perform them.

Safety Professional -

When all of the SP Administrator, SP Professional, and SP In Training occupational levels and the Class B, C, and D functional levels were evaluated, the results indicate no significant differences between either the SP In Training, the SP Professional, or the SP Administrator within the Class B, the Class C, or the Class D functional levels. While the proportions are numerically different, there is no statistically significant difference at the 0.5 level. (The test method is described in detail in Technical Report V and in the Appendix of Technical Report IX.)

In referring to the R category in Table V-3, a total of 63 tasks/activities were assigned to the combined occupational levels that include SP In Training, SP In Training-Professional, and SP In Training-Professional-Administrator. Of these 63 tasks/activities, 39 (62%) were also "performed" by at least one-third of the IH In Training, IH In Training-Professional, and IH In Training-Professional-Administrator.

In the S category, a total of 35 tasks/activities were assigned to the SP Professional occupational level. Note that at least one-half of the SP Incumbent Professionals performed these tasks/activities while at least one-third of the designated Incumbents performed the R category of tasks/activities. Eighteen (50%) of the S category were also assigned as performed by the IH Professional.

The T category was restricted to the tasks/activities performed by the SP Professional-Administrator and the SP Administrator occupational levels. A total of 8 tasks/activities were designated to this category; 6 of these tasks/activities were also assigned as performed by at least one-third of the IH Professionals and IH Administrators.

As mentioned earlier, two additional categories, Y and Z, were developed for the "Technician" and "Technician-In Training" occupational level of tasks/activities that are being "performed" by IH Professionals and SP Professionals. The Z category pertains to SP Professionals.

The SP Incumbent Professionals are performing 23 tasks/activities which the *Safety Professional* Expert Practitioners indicated should be performed by SP Technicians and/or SP In Training personnel. Note that the Incumbent SP Professionals are certified by the BCSP and that 12 of the 15 *Safety Professional*

Expert Practitioners were also BCSP certified. The Expert Practitioners believed that the 23 tasks/activities should be performed by SP Technicians and/or SP In Training. In the Z category, at least one-third of the SP Professionals performed 12 tasks/activities; 7 air quality, 4 physical exposure, and 1 materials handling. At least one-half of the SP Professionals performed 4 SP Technician and/or SP In Training level tasks/activities; 3 air quality and 1 general. Seven of the tasks/activities were performed by at least two-thirds of the Incumbent Safety Professionals; 5 general, 1 physical exposure, and 1 materials handling.

It is evident that the same factors that may have affected the performance of the Incumbent IH Professionals may have also affected the performance of the Incumbent SP Professionals on these 23 tasks/activities:

1. The Expert Practitioners may have misjudged the level of assignment.
2. The educational level of the 127 Incumbent SP Professionals is not required to perform this level of tasks/activities (83% of the SP Professionals had at least a baccalaureate degree; 50 had baccalaureate degrees, 17 had master's degrees, 3 had doctorate degrees, and 31 had graduate study with no degrees).
3. There is a shortage of qualified SP Technician and/or SP In Training personnel.

As with the IH Professional level, it is believed that the third factor--the shortage of qualified personnel at the SP Technician and/or SP In Training levels--is responsible for the performance of these tasks/activities by highly educated and experienced personnel.

DISCUSSION

Indications are that both the American Board of Industrial Hygiene (ABIH) and the Board of Certified Safety Professionals (BCSP) are currently involved in self-appraisal of the certification process.

(a) Consideration is being given to the maintenance of certification, e.g., through Continuing Education Units that may be accumulated through completion of formal educational courses, completion of special short courses or "refresher" courses, attendance at approved conferences, and other methods.

(b) Currently, an ad hoc committee, composed of three members of the ABIH and the BCSP, is exploring areas of cooperation between the two Boards.

(c) The ABIH initiated a certification procedure for the classification of Industrial Hygiene Technologist in 1975. An examination has been developed. The Roster of the American Academy of Industrial Hygiene (1976-1977) reveals that 20 Industrial Hygiene Technologists have been certified in this new classification.

(d) The Board of Certified Safety Professionals is currently considering a revision of their examination/certification process; the examination will consist of two levels; a basic or "core" examination followed by specialty examinations in Comprehensive Practice, Engineering and Management. After completion of the basic or "core" examination, the successful candidate would achieve the designation of "Associate Safety Professional." Successful completion of a specialty examination would result in the designation of Certified Safety Professional--Engineering, for example.

There is ample evidence that the ABIH and the BCSP are concerned and involved with examination and certification processes in fulfilling the objective of active participation in identifying and attesting to the qualifications and capabilities of individuals in the categories of *Industrial Hygiene* and *Safety Professional*.

Certification by the ABIH and the BCSP, as indicated by the Incumbents, has been utilized in this Project to assist in the classification of four occupational levels; IH Administrator, IH Professional, SP Administrator, and SP Professional. Accordingly, data has been collected and reported in Technical Reports IV and IX relative to the tasks/activities performed by Incumbents in these four (4) occupational levels.

Evaluation of the data collected and analyzed in this Project is helpful in identifying and indicating alternate "methods" and "requirements" that could be considered by the National Institute for Occupational Safety and Health (NIOSH) in cooperation with the American Board of Industrial Hygiene and the Board of Certified Safety Professionals. Three alternate "methods" considered to be important by the Project Staff are proposed.

I. DEVELOP A SERIES OF COURSES THAT, WHEN SUCCESSFULLY COMPLETED, WOULD BE EQUALED TO CERTIFICATION.

Such a rationale would require close cooperation and involvement with the two certifying Boards, the ABIH for the *Industrial Hygiene* category and the BCSP for the *Safety Professional* category. For purposes of discussing this proposed method, only the IH In Training, the IH Professional, the SP Professional occupational levels (as defined in this Project) are considered.

The proposed requirements for such a method include:

1. A series of courses to be developed around performance objectives; performance objectives to be approved by the respective Board, courses developed under NIOSH sponsorship, and courses approved by the respective Board.
2. Courses to be taught in existing "institutions" (not necessarily academic institutions) by selected faculty. Both the institution and the faculty to be approved by NIOSH and the respective Board.
3. Pre-test for each course to be developed under NIOSH sponsorship and each pre-test to be approved by the respective Board.
4. Examinations, including a post-test, for each course to be developed under NIOSH sponsorship and each examination to be approved by the respective Board.
5. The examination(s) to be administered by the respective Board(s) under existing procedures for ABIH and BCSP examinations. It is extremely important that the course instructor(s) not be permitted to administer the examinations; it is important that the instructor not "teach the examination".
6. Individuals desiring to complete the series of courses would possess baccalaureate academic qualifications meeting the qualifications agreed upon by NIOSH and the respective Board.
7. Individuals desiring to complete the series of courses would possess work experiences, or would gain the experience before completion of the courses, such work experience to meet the requirements agreed upon by NIOSH and the respective Board.

8. Alternatives exist for certification of an individual who has successfully completed the series of courses and met the experience criteria. Such alternatives include:
   (a) Immediate certification by the respective Board as a Certified Industrial Hygienist or as a Certified Safety Professional (certification by both Boards in Comprehensive Practice is assumed). The normal examination processes of the two Boards would be circumvented by examination processes built into the series of courses. Strict quality control of examinations would be a necessity.
   (b) Immediate certification by the respective Board as an Industrial Hygienist In Training or as an Associate Safety Professional. Strict control of the courses and examinations is implied.
   (c) Immediate qualification for taking the certification examinations administered by the ABIH and the BCSP.
   (d) Alternate certification procedures by another interested party, for example, NIOSH.

Under this proposed method of certification, it is assumed that the normal 5 years of experience for certification would be reduced to a lower level, for example, 3 years. The quality-controlled series of courses (controlled in developing, teaching, and examining) would serve as "experience compressors" to provide a rapid influx of Board certified professionals with acceptable qualifications.

As a "plus" to the development and implementation of the series of courses, the ABIH and the BCSP could consider giving credit toward "maintenance of certification" for those individuals currently certified who would take select courses. A continuing education unit scheme would be part of the course development.

II. DEVELOP CURRICULA THAT, WHEN SUCCESSFULLY COMPLETED, WOULD PERMIT THE GRADUATE TO IMMEDIATELY TAKE THE INDUSTRIAL HYGIENE IN TRAINING OR THE ASSOCIATE SAFETY PROFESSIONAL EXAMINATION.

Utilizing the present funding mechanism of NIOSH, the approval of the ABIH and the BCSP, and the approval of proper accrediting entities; develop accredited curricula at the baccalaureate and graduate level. Upon graduation, the graduate would be permitted to take the respective Board's "core" level examination, and if successful, would be granted the implied level of certification. Such a strategy would command intensive and close cooperation between the above mentioned entities. The curricula to be developed and proposed in this Project could serve as the base from which such an effort could be developed.

III. DEVELOP AND PUBLISH A PORTFOLIO OF PERFORMANCE OBJECTIVES APPROVED BY THE AMERICAN BOARD OF INDUSTRIAL HYGIENE AND THE BOARD OF CERTIFIED SAFETY PROFESSIONALS TO SERVE AS A GUIDE FOR THOSE INDIVIDUALS WHO ASPIRE TO CERTIFICATION BY THE RESPECTIVE BOARDS.

A portfolio of performance objectives (patterned after the performance objectives developed in this Project) supplied to potential candidates for certification by either Board could be invaluable in preparation for the certification examinations. Such a portfolio could, after development and approval by the two Boards, ultimately result in the utilization of performance objectives in the development of examination content.

The following are suggested alternate "requirements" that may be considered for certification and include the development of two new but needed areas of competence.

I. DEVELOPMENT OF AN OCCUPATIONAL HEALTH AND SAFETY "GENERALIST" OR "SPECIALIST" EXAMINATION BY JOINT ACTION OF THE AMERICAN BOARD OF INDUSTRIAL HYGIENE AND THE BOARD OF CERTIFIED SAFETY PROFESSIONALS.

As mentioned earlier, the ABIH and the BCSP are currently exploring areas of cooperation through an ad hoc committee. The preponderance of data in this research supports such an effort. For example, in the categories of tasks/activities characterized as M, N, and O (Table V-3, page 119), and assigned as "performed" by IH In Training, IH Professional, and IH Administrator; 82% of these tasks/activities are also "performed" by SP In Training, SP Professional, and SP Administrator.

These data are tabulated below.

CATEGORIES	TOTAL TASKS/ACTIVITIES	JOINTLY ASSIGNED TO IH AND SP	PERCENT
M	45	39	87
N	26	18	69
O	6	6	100
TOTALS	77	63	82

The categories of tasks/activities characterized as R, S, and T (Table V-3), and assigned as "performed" by SP In Training, SP Professional, and SP Administrator reflect that 59 percent of these tasks/activities are also "performed" by IH In Training, IH Professional, and IH Administrator.

These data are tabulated as follows:

CATEGORIES	TOTAL TASKS/ACTIVITIES	JOINTLY ASSIGNED TO SP AND IH	PERCENT
R	63	39	62
S	35	18	51
T	8	6	75
TOTALS	106	63	59

Over all categories and assignments, 69% of the tasks/activities in these groups are jointly performed by *Industrial Hygiene* and *Safety Professional* personnel.

In addition, some of the 46 tasks/activities in category Y (assigned by the Expert Practitioners to be "performed" by IH Technician or IH In Training) could possibly be incorporated into an Occupational Health and Safety "Specialist" certification. The 23 tasks/activities in category Z could, in part, be incorporated into a "Specialist" certification even though the tasks/activities are assigned as "performed" by SP In Training or SP Technician levels and are actually performed by SP Professionals.

Reference should be made to the statistical treatment of the Expert Practitioner data in Report III and Incumbent data in Reports IV and IV-A. For example, "performed" does not indicate that a simple majority of the respondents in either group performed the task/activity or indicated that it should be performed. "Performed" should be interpreted to mean that a statistically defined proportion of the Expert Practitioners and the Incumbents indicated the task/activity should be "performed" or "was performed" at the designated level.

II. DEVELOPMENT OF A SPECIALTY EXAMINATION AND CERTIFICATION BY THE AMERICAN BOARD OF INDUSTRIAL HYGIENE IN THE AREA OF INDUSTRIAL HYGIENE MANAGEMENT

It is obvious that Industrial Hygiene Management is an art and science of increasing importance. The interface between the profession of *Industrial Hygiene* and the user population--the employee, the public, the government, and the employer--makes it increasingly clear that the management of this technical function should not be left to administrative policies developed by individuals who may not be fully aware of all circumstances and possible consequences resulting from misapplication of Industrial Hygiene resources. Effective Industrial Hygiene Management will require an increased knowledge and awareness of economics, methods, materials and other resources. The knowledge and ability to develop alternative solutions affecting the health and safety of employees, the well-being of the public, and the economic health of the employer will become increasingly important.

This Project has identified 107 tasks/activities that could logically fall into the province of the Industrial Hygiene Manager.

Certification as an Industrial Hygiene Manager (or as an Industrial Hygiene Administrator as identified in this Project) would attest to competence in the management of the occupational health and safety function. Certification as an Industrial Hygiene Manager could be by examination through the American Board of Industrial Hygiene and would be available only to individuals who were Certified Industrial Hygienists thereby attesting to the required technical competence in Industrial Hygiene as well as the required managerial abilities. Obviously such certification could also be accomplished through the mechanism of a series of courses as enumerated in Alternate Method I.

There may be alternate methods of certification and alternate requirements for certification other than the five alternatives described in this Report. However, study of the present certification procedures of the ABIH and BCSP and evaluation of the data collected and analyzed in this research do not appear to support additional considerations for certification other than the five alternatives listed in this Report.

SUMMARY

The subsequent analyses of the data collected on the Expert Practitioner and Incumbent personnel responses to the task/activity survey form led to an evaluation of possible requirements and methods for certification as an Industrial Hygiene Technician and a Safety Professional Technician.

The data indicated that there is no clearly defined distinction between the two occupational categories, and therefore, did not support the development of methods and requirements for certification of Industrial Hygiene and Safety Professional Technicians. However, education/training programs are suggested that could produce "certifiable" technicians in either category or the programs could be combined to produce an "occupational health and safety" technician.

The subsequent analyses of the data collected on the Expert Practitioner and Incumbent personnel responses to the task/activity survey form led to an evaluation of the current certification requirements and methods for certification as an Industrial Hygienist and Safety Professional. From the task/activity assignments of occupational levels and academic levels made by the Expert Practitioners and Incumbents, listings of the tasks/activities performed by the In Training, Professional, and Administrator personnel within the Industrial Hygiene and Safety Professional categories were developed. These listings were used to formulate five alternative requirements and methods for certification of the Industrial Hygiene and Safety Professional In Training, Professional and Administrator personnel.

Alternate suggestions have been made that could augment current certification methods of the American Board of Industrial Hygiene and the Board of Certified Safety Professionals.

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CHAPTER VI

PERFORMANCE OBJECTIVES

Objective VI.

> *To develop behavioral objectives based on task/activity analysis and recommend alternate training/education routes for preparing individuals to enter and progress in these two occupations.*

From the analyses described in preceding sections, tasks/activities determined to be needed in the curricula for *Industrial Hygiene* and *Safety Professional* personnel were the basis for the development of performance objectives for those curricula. The performance objectives were developed as terminal objectives for courses of study which will prepare individuals to enter *Industrial Hygiene* and *Safety Professional* occupations and to be able to execute the tasks/activities which the Expert Practitioners and Incumbents indicated as being performed. Each performance objective is intended to communicate the desired pattern of behavior (performance) to be demonstrated by the learner following a period of instruction for a given task/activity. The performance objectives were developed and reported in Technical Reports VI and X and are also included in Technical Reports VII and XI as curricula units.

PROCEDURES

Each performance objective was written to define what the student is to be able to do at the end of instruction in a specific task/activity or group of related tasks/activities in a given simulated environment of a classroom or laboratory. Each performance objective includes the following:

1. a task/activity statement as used throughout the project.
2. a statement identifying the overall performance required (i.e., what the learner will be doing). Examples of this statement are, "to demonstrate," "to list," "to describe," etc.
3. a statement defining the important conditions under which the performance is to occur (i.e., "givens" and/or "restrictions"). Examples of this statement are "Given a properly functioning instrument ...," "without the aid of references ...,", etc., and
4. a statement defining the criterion of acceptable performance (i.e., how the learner will be evaluated). Examples of this statement are "... 5 principles must be identified," "... must be completed within 60 minutes," etc.

In the process of developing the performance objectives, technical background information was drawn from a number of authoritive technical references. Those used are listed at the end of this section.

RESULTS

The performance objectives which resulted from the task/activity analysis were too extensive to include in this report. The comprehensive listings of performance objectives for the *Industrial Hygiene* and *Safety Professional* categories are shown in conjunction with the appropriate tasks/activities in Technical Report VI for IH Technicians and SP Technicians and in Technical Report X for IH In Training, Professional and Administrator levels and for SP In Training, Professional and Administrator levels.

Examples of performance objectives have been selected which were specifically assigned to each *Industrial Hygiene* and *Safety Professional* occupational level. These are listed for each occupational level.

IH TECHNICIAN

Sampling locations you use to obtain air samples include the breathing zone.

Given a calibrated and properly functioning air sampling device (e.g., personal sampler, direct reading colorimetric tube, etc.), the student is able to demonstrate the use of the device in collecting an air sample in the breathing zone of a given employee working in a specified environment in which a known airborne particulate exists.

IH IN TRAINING

Make recommendations concerning procedures, layout and equipment used in laboratories within your organization.

Given plans, specifications, list of equipment, list and quantities of materials, and procedures, the student will be able to list ten (10) appropriate recommendations relative to

(a) storage of materials

(b) control of toxic exposures

(c) control of flammable exposures

(d) location of equipment

(e) emergency procedures

(f) exit from the laboratory space.

IH PROFESSIONAL

Do you design noise isolation enclosures?

Given:

1) a plan and isometric drawing (including dimensions) of a compressor unit,
2) data relating to the sound power of the source, sound level readings at various points around the source (including octave band spectra),
3) data relating to cooling requirements for the compressor,
4) a selection of acoustical materials with Transmission Loss (TL) data specifications for each material,
5) data relating to position of operators in the area,

the student will be able to determine the required Transmission Loss (TL) for the enclosure material using the procedure described in the Industrial Noise Manual (AIHA), p. 122-217.

IH ADMINISTRATOR

Analyze the results of such items as physical examinations, biochemical monitoring and audiometric tests, in conjunction with medical personnel.

Given copies of typical physical examinations, biochemical test results, and audiometric tests results, the student will be able to analyze these relative to job classification and occupational health/safety exposures and prepare a report for consultation with medical personnel.

SP TECHNICIAN

Types of equipment you use for air quality surveys: combustible gas detector.

Given a calibrated and properly functioning combustible gas detector with accompanying written operating instructions, the student is to be able to demonstrate the use of the combustible gas detector in measuring the concentration of the combustible gases in a given general work area environment.

SP IN TRAINING

Make recommendations concerning product data sheets, operating and assembly instructions, etc., for products produced.

1. Given a specific product and related product data sheets, the student will be able to complete a Preliminary Hazard Analysis and to identify and qualify the significantly important exposures following the criteria established in Military Standard 882.

2. Given operating and assembly instructions relating to a specific product, the student will be able to complete a Procedure Analysis following the guidelines established in Occupational Safety Management and Engineering (Hammer).

SP PROFESSIONAL

Do you use ergonomic principles to modify or design work methods, procedures or workplace layouts?

Given a specific job procedure or a specific workplace layout (man/machine/environment relationships), the student will be able to list eight (8) specific ergonomic procedures that should be considered relative to the specific procedure or workplace. Guidelines provided in Fundamentals of Industrial Hygiene (National Safety Council) and Human Factors Engineering (McCormick) are to be utilized.

SP ADMINISTRATOR

Select and evaluate performance of health/safety personnel.

1. Given typical job descriptions and a sample of completed application forms for these positions:

   (a) Industrial Hygiene Technician
   (b) Safety Professional Administrator
   (c) Safety Manager
   (d) Industrial Hygiene Professional

   the student will be able to select and justify in writing the reasons for the selections within guidelines described in the Accident Prevention Manual for Industrial Operations (National Safety Council), certification requirements published by the American Board of Industrial Hygiene and the Board of Certified Safety Professionals, and The Industrial Environment--Its Evaluation and Control, Chapter 48 (U.S. DHEW).

2. Given typical job descriptions, the student will be able to develop and write an evaluation format (qualitative measurements) for evaluating the performance of individuals employed in these positions:

   (a) Industrial Hygiene Technician

   (b) Industrial Hygiene Professional

   (c) Safety Professional

   within guidelines described in the Accident Prevention Manual for Industrial Operations (National Safety Council), certification requirements published by the American Board of Industrial Hygiene and the Board of Certified Safety Professionals, and The Industrial Environment--Its Evaluation and Control, Chapter 48 (U.S. DHEW).

DISCUSSION

Performance objectives of the greatest value, in the instructional context, have a specific inferential measure or some precise measure of acceptable performance. In this manner, both the educator and the student understand what constitutes successful achievement of the stated objective. Due to the nature of some of the tasks/activities performed by the *Industrial Hygiene* and *Safety Professional* categories, a statement in the performance objective defining a specific measure of acceptable performance was not always appropriate. In some cases, then, it is noted that the acceptable performance may be empirical, that is, based on observation and/or experience. Since these performance objectives are intended to be used as guidelines within *Industrial Hygiene* and *Safety Professional* curricula, the user is encouraged to modify the performance objectives to include more precise measures of acceptable performance when it is considered to be appropriate.

SUMMARY

Tasks/Activities indicated by the Expert Practitioners and Incumbents in the task/activity analysis as being necessary in the curricula for preparing *Industrial Hygiene* and *Safety Professional* personnel were used as the basis for developing performance objectives for those curricula. The performance objectives were developed to communicate the desired pattern of behavior to be demonstrated by the learner following a period of instruction.

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CHAPTER VII

CURRICULA

Objective VII.

To develop task-oriented curricula, including curricular units, which will be designed to produce the specific knowledge and skills required for an individual to perform specific tasks determined as necessary for upward mobility and certification in these two occupations.

To ascertain the competencies or the skill and knowledge requirements for curricula development in the two professional categories of Industrial Hygiene and Safety Professional and the eight occupational levels within the two categories, it was necessary to acquire and analyze data concerning the job requirements placed on individuals employed in these occupations. In addition to determining the tasks/activities performed by individuals, it was desirable to acquire individual background characteristics indicating age, education, training, experience, certification, type of industry, etc. Accordingly, the following were accomplished:

(1) the selection of an Advisory Group of Expert Consultants (Chapter II)

(2) the development of a Task/Activity Analysis Survey Form (Chapter II)

(3) approval of the 753 task/activity survey form by the Advisory Group of Expert Practitioners and the Sponsor (Chapter II)

(4) selection of two 16-man Expert Practitioner Committees; one composed of Industrial Hygienists and the other composed of Safety Professionals (Chapter II)

(5) completion of the survey forms by the Expert Practitioners (Chapter II)

(6) selection of a random sample of "Contact Persons" representing major SIC codes and selection of a random sample of individuals employed in occupational safety and health within the "Contact Persons" company (Chapter I)

(7) compilation and analysis of the data to determine performance levels, prerequisite knowledge required, assignment of tasks/activities to subject area categories, background characteristics of respondents, etc. (Chapter III)

(8) consolidate the previously acquired data to derive job requirements, including skills and knowledges (Chapter IV)

(9) study certification requirements and methods for the Industrial Hygiene and the Safety Professional occupations (Chapter V)

(10) develop performance objectives based on task/activity analysis (Chapter VI)

PROCEDURE

Analysis of data provided by the Expert Practitioners is described in Chapter II. The acquisition and analysis of Incumbent data is described in Chapter III. Consolidation of the data is described in Chapter IV. The complete development of curricula are the purposes of Technical Reports VII and XI. To summarize, the Expert Practitioners studied each of 753 tasks/activities; they assigned each task/activity to a performance level and suggested academic levels/prerequisite knowledgerequired for each of the task/activity. The Incumbents provided personal background data and the frequency level at which they performed each task/activity. The Expert Practitioner data and the Incumbent data were merged and decisions were made reference the tasks/activities which were "performed" or "not performed" and assignments were made to occupational levels within the *Industrial Hygiene* and the *Safety Professional* categories.

Following the determinations of task/activity assignments, performance objectives were developed for each performed task/activity. These performance objectives were subsequently used by the Expert Practitioners and the Advisory Group of Expert Consultants in determining the academic level to which each task/activity and related performance objective should be assigned, i.e., Associate, Baccaluareate, or Graduate. These procedures are described in Technical Report XI.

RESULTS

The Occupational Health and Safety Technician Curricula

The curriculum for the education and training of an occupational health and safety technician is presented in Table VII-1. The objective of this curriculum is to provide for the attainment of an Associate of Science degree in Occupational Health and Safety. The curriculum is based upon a two-year, two-semester program. During this period of time, the student will receive between 62 and 64 credit hours of instruction in Occupational Health and Safety as well as related subjects and electives. A total of 16 to 17 hours per semester are required for completion of the program.

Because of the requirements of the particular Occupational Health and Safety courses included in the curriculum as well as related courses, such as general chemistry and communication, only a few elective hours (a maximum of 16) are provided for in the curriculum. This could present some problems in particular locations where additional electives are required to meet state or college requirements for the attainment of an associate degree. In such cases, additional courses may be taken during the summer, or the program may result in a certification which can be converted to an associate degree upon completion of the required non-Occupational Health and Safety courses.

The curriculum is designed as a terminal degree program. That is, the curriculum is designed to produce an individual who, upon completion of the curriculum, can enter the Occupational Health and Safety field in industry and perform at a technician level. As such, the curriculum is not designed to be upward transferrable to the baccalaureate level. However, most of the

TABLE VII-1

SUGGESTED CURRICULUM

ASSOCIATE OF SCIENCE DEGREE
OCCUPATIONAL HEALTH AND SAFETY TECHNICIAN

Ref	Title	Th	Lab	Cr
Year 1--Semester 1				
1	Introduction to Occupational Health and Safety	3	0	3
2	Mathematics for Occupational Health and Safety	3	0	3
3	General Chemistry I	3	3	4
4	Introduction to Industrial Processes	3	3	4
5	Communications I	3		3
	Total			17
Year I--Semester 2				
6	Recognition, Measurement, and Evaluation of Hazards to Worker Safety	3	0	3
7	Recognition, Evaluation, and Control of Flammable Materials	3	0	3
8	General Chemistry II	3	3	4
9	Physical Sciences	3	3	4
10	Communications II	3	0	3
	Total			17
Year 2--Semester 1				
11	Toxic Substances in Industry	3	0	3
12	Recognition, Measurement, and Evaluation of Physical Exposures	3	3	4
13	Emergency Treatment of Illness and Injury	2	0	2
	Electives or Required Courses	7-8		7-8
	Total			16-17
Year 2--Semester 2				
14	Recognition, Measurement, and Evaluation of Airborne Contaminants	3	6	5
15	Introduction to General Control Methods	3		3
16	Training Workers in Safety and Health	3		3
	Electives or Required Courses	5-6		5-6
	Total			16-17

specific Occupational Health and Safety courses included in the curriculum are such that credit would be granted toward the attainment of a baccalaureate program should the student wish to transfer to a baccalaureate program. It is likely that such a student would find it necessary to make up credit in the General Science, Mathematics, and Engineering categories before attaining third-year status in a baccalaureate program.

The major emphasis of the curriculum is on the recognition, measurement, and evaluation of potential hazards. This emphasis is based upon the analysis of the data collected which seemed to indicate that tasks falling in these functional classifications were most commonly performed by individuals in the technician category. Control of potential hazards, which based upon the data gathered is more normally assigned to higher level education, is discussed only in general terms in the course entitled "Introduction to General Control Methods" given in the second semester of the second year. One course which deals with specific control measures to be taken for flammable material exposures, entitled "Recognition, Evaluation, and Control of Flammable Materials," is presented in the second semester of the first year.

The data gathered from incumbents reporting performance of tasks in the field indicates a significant crossover at the technician level. Specifically, if it is assumed that the task is performed by a particular level if a statistical estimate of the population performance yields one-third of the population performing the task, then a total of 640 responses fall in this category for either the industrial hygiene technician, safety professional technician, or both. Of these 640 task/activity responses, 327 or 51% were performed by both the industrial hygiene and the safety professional technician.

Two options existed for the Project Staff to develop a curriculum to train technicians. These options were to develop separate associate degree programs for industrial hygiene technicians and safety professional technicians or to develop a combined program for an occupational health and safety technician. Two factors were significant in the decision to develop a combined program: first, the great cross-over of performance of tasks/activities between respondents in the industrial hygiene technician level and the safety professional technician level in the survey; second, the fact that the tasks/activities and related performance objectives did not easily logically group into courses using the exposure and classification grouping criteria. Although it was found that a predominant number of tasks in the air quality exposure area were performed by industrial hygiene technicians rather than safety professional technicians, the preference in performance was not complete. Certain tasks within the air quality exposure group were also performed by safety professional technicians, indicating that some education was necessary in this area. This fact was further substantiated when looking at the assignments made by the Expert Practitioner group.

An additional consideration by the Project Staff was the fact that the course materials developed individually for each technician level did not provide sufficient course work to complete a two-year program. Thus, it was decided to combine the two technician levels into one Occupational Health and Safety technician program at the associate level.

In those cases where it is desired to provide education and training for either an occupational health technician or an occupational safety technician, certificate programs leading to either of the above technician categories are presented in Tables VII-2 and VII-3. Because of the necessary overlap in courses, as indicated from the data received, each certificate program will require three semesters for completion. The Occupational Health Technician curriculum requires five more credit hours for completion than does the Occupational Safety Technician. The basic courses which are

TABLE VII-2

CERTIFICATE PROGRAM
OCCUPATIONAL SAFETY TECHNICIAN

Ref	Title	Th	Lab	Cr
Semester 1				
1	Introduction of Occupational Health and Safety	3	0	3
2	Mathematics for Occupational Health and Safety	3	0	3
4	Introduction to Industrial Processes	3	3	4
5	Communications I	3	0	3
9	Physical Sciences	3	3	4
	Total			17
Semester 2				
6	Recognition, Measurement, and Evaluation of Hazards to Worker Safety	3	0	3
7	Recognition, Evaluation, and Control of Flammable Materials	3	0	3
10	Communications II	3	0	3
11	Toxic Substances in Industry	3	0	3
12	Recognition, Measurement, and Evaluation of Physical Exposures	3	3	4
	Total			16
Semester 3				
13	Emergency Treatment of Illness and Injury	2	0	2
15	Introduction to General Control Methods	3	0	3
16	Training Workers in Safety and Health	3	0	3
	Total			8
	Total Credit Hours			41

TABLE VII-3

CERTIFICATE PROGRAM
OCCUPATIONAL HEALTH TECHNICIAN

Ref	Title	Th	Lab	Cr
Semester 1				
1	Introduction to Occupational Health and Safety	3	0	3
2	Mathematics for Occupational Health and Safety	3	0	3
3	General Chemistry I	3	3	4
4	Introduction to Industrial Processes	3	3	4
5	Communications I	3	0	3
	Total			17
Semester 2				
8	General Chemistry II	3	3	4
9	Physical Sciences	3	3	4
10	Communications II	3	0	3
11	Toxic Substances in Industry	3	0	3
16	Training Workers in Safety and Health	3	0	3
	Total			17
Semester 3				
12	Recognition, Measurement and Evaluation of Physical Exposures	3	3	4
14	Recognition, Measurement, and Evaluation of Airborne Contaminants	3	6	5
15	Introduction to General Control Methods	3	-	3
	Total			12
	Total Credit Hours			46

used in both curricula are the same as those referenced in the suggested curriculum for an associate degree in Occupational Health and Safety. These curricula provide an option where the required course load for receipt of an associate degree at a particular college is such that more hours are needed than available in the combined curriculum.

The Industrial Hygiene Baccalaureate Curriculum

The *Industrial Hygiene* curriculum consists of 130 credit hours of instruction based on a normal academic semester of fifteen weeks. This includes thirty-five courses; fourteen occupational health and safety "specific" courses developed within this project and twenty-one related courses plus the opportunity for twenty-one elective credit hours as determined by an individual and his/her college or university. Thirteen of the "specific" courses have a total of 417 performance objectives assigned to them for an average of thirty-two performance objectives per course.

For the related courses, emphasis has been given to the relative values previously determined which indicated a need for emphasis in the physical sciences, biological sciences, engineering sciences, and mathematical sciences as reported in Technical Report XI. This is reflected in the courses in Biology and Human Physiology, Physics and Chemistry, Analytical Geometry and Calculus, and in Design Graphics and Engineering Analysis. The related courses probably exist in most colleges and universities, and it is assumed that accreditation standards are met, therefore, the courses are not further defined in this project.

TABLE VII-4

RECOMMENDED BACCALAUREATE DEGREE PROGRAM FOR INDUSTRIAL HYGIENE

FRESHMAN YEAR

	Theory-Lab	Credit		Theory-Lab	Credit
Analytical Geometry	3 - 0	3	Composition & Rhetoric II	3 - 0	3
Biology	3 - 3	4	General Chemistry II	3 - 3	4
Composition & Rhetoric I	3 - 0	3	Integral Calculus	3 - 0	3
Design Graphics	1 - 3	2	Introduction to Industrial Processes	2 - 3	3
General Chemistry I	3 - 3	4	Introduction to Occupational Health and Safety	3 - 0	3
		16			16

SOPHOMORE YEAR

	Theory-Lab	Credit		Theory-Lab	Credit
Differential Calculus	3 - 0	3	Field Instrumentation	2 - 3	3
General Concepts in Occupational Health and Safety	2 - 0	2	Physics II	3 - 3	4
Human Physiology	2 - 3	3	Statistics	3 - 0	3
Organic Chemistry	3 - 3	4	Technical Writing	3 - 0	3
Physics I	3 - 3	4	Approved Elective		3
		16			16

JUNIOR YEAR

	Theory-Lab	Credit		Theory-Lab	Credit
Business Management	3 - 0	3	Air Quality for Industrial Hygiene	2 - 3	3
Engineering Analysis	3 - 3	4	Business Law	3 - 0	3
Hazardous Materials for Industrial Hygiene	3 - 0	3	Economics	3 - 0	3
Laboratory Instrumentation and Analysis	2 - 3	3	Education/Training Methods for Industrial Hygiene	2 - 0	2
Approved Elective		3	Physical Exposures for Industrial Hygiene	2 - 3	3
		16	Approved Elective		3
					17

SENIOR YEAR

	Theory-Lab	Credit		Theory-Lab	Credit
Flammable Materials for Industrial Hygiene	3 - 0	3	Evaluation and Control Methods in Occupational Health and Safety (IH)	2 - 3	3
Human Factors	3 - 0	3	Management Techniques in Occupational Health and Safety (IH)	3 - 0	3
Industrial Relations	3 - 0	3	Materials Handling for Industrial Hygiene	3 - 0	3
Noise Evaluation and Control	2 - 3	3	Approved Electives		6
Approved Electives		6			15
		18			

Total Semester Hours - 130

The Industrial Hygiene Baccalaureate curriculum is presented in Table VII-4. Individual Industrial Hygiene courses are described in Appendix V. Further details are presented in Technical Report XI.

The Safety Professional Baccalaureate Curriculum

The *Safety Professional* curriculum contains 130 semester credit hours of instruction. This includes thirty-four courses; thirteen occupational safety and health "specific" courses developed within this project and twenty-one related courses plus the opportunity for twenty-five elective credit hours. Twelve of the specific courses have a total of 435 performance objectives assigned to them or an average of thirty-six performance objectives per course.

For the related courses, emphasis was given to those academic areas indicated as needed by the relative values indicated in Technical Report XI. The related knowledge is comparable to that determined for the Industrial Hygiene baccalaureate degree. There is some additional requirement in Engineering Science.

The Safety Professional Baccalaureate curriculum is presented in Table VII-5. Individual Safety Professional courses are described in Appendix VI.

Considerations for an Occupational Health and Safety "Generalist" Curriculum

In Technical Report IX of this project, it was indicated that a significant proportion of the data collected suggested that a "generalist" in occupational health and safety could be educated and trained to perform, at an acceptable level, many of the currently performed tasks/activities. This is further evidenced by the number of identical tasks/activities

TABLE VII-5

RECOMMENDED
BACCALAUREATE DEGREE PROGRAM
FOR SAFETY PROFESSIONAL

	Theory-Lab	Credit		Theory-Lab	Credit
FRESHMAN YEAR					
Analytical Geometry	3 - 0	3	Composition & Rhetoric II	3 - 0	3
Composition & Rhetoric I	3 - 0	3	General Chemistry II	3 - 3	4
Design Graphics	1 - 3	2	Graphical Analysis	2 - 3	3
General Chemistry I	3 - 3	4	Integral Calculus	3 - 0	3
Introduction to Industrial Processes	2 - 3	3	Introduction to Occupational Health and Safety	3 - 0	3
		15			16
SOPHOMORE YEAR					
Differential Calculus	3 - 0	3	Air Quality for the Safety Professional	2 - 3	3
General Concepts in Occupational Health and Safety	2 - 0	2	Physics II	3 - 3	4
Human Physiology	2 - 3	3	Statistics	3 - 0	3
Organic Chemistry	3 - 3	4	Technical Writing	3 - 0	3
Physics I	3 - 3	4	Approved Elective		3
		16			16
JUNIOR YEAR					
Business Management	3 - 0	3	Business Law	3 - 0	3
Engineering Analysis	3 - 3	4	Economics	3 - 0	3
Hazardous Materials for the Safety Professional	3 - 0	3	Flammable Materials for the Safety Professional	3 - 0	3
Physical Exposures for the Safety Professional	2 - 3	3	Mechanical and Electrical for the Safety Professional	3 - 0	3
Approved Elective		4	Approved Elective		6
		17			18
SENIOR YEAR					
Education/Training Methods for the Safety Professional	2 - 0	2	Evaluation and Control Methods in Occupational Health and Safety (SP)	2 - 3	3
Facilities for the Safety Professional	3 - 0	3	Management Techniques in Occupational Health and Safety (SP)	3 - 0	3
Human Factors	3 - 0	3			
Industrial Relations	3 - 0	3	Materials Handling for the Safety Professional	3 - 0	3
Approved Elective		6	Approved Elective		6
		17			15

Total Semester Hours - 130

that are included in the foregoing curricula for *Industrial Hygiene* and *Safety Professional* categories. These tasks/activities are listed below by courses.

Course	Number	Percent of Industrial Hygiene	Percent of Safety Professional
	Number and Percent of Tasks/Activities Jointly Listed in *Industrial Hygiene* and *Safety Professional* Curricula		
Introduction to Occupational Health and Safety	72	100	100
General Concepts in Occupational Health and Safety	25	100	100
Air Quality	29	60	74
Physical Exposures	32	74	68
Hazardous Materials	33	72	97
Flammable Materials	32	89	80
Materials Handling	15	65	34
Education/Training Methods	11	92	55
Management Techniques	8	30	29
Evaluation and Control Methods	5	33	21
	165	47	44

Therefore, approximately forty-five percent of the tasks/activities designated to the ten courses listed above are also included in the *Industrial Hygiene* and in the *Safety Professional* curricula. (Note that these ten courses contain a total of 347 tasks/activities in the *Industrial Hygiene* curriculum and 373 tasks/activities that are jointly listed in the two curricula.) While the graduate of such a curriculum may be neither an Industrial Hygienist nor a Safety Professional, the graduate could possibly qualify as a technologists or an associate in either professional category.

Some academic institutions may desire a combination curriculum of this type. Given that related courses are carefully selected, the jointly listed tasks/activities could serve to augment existing environmental science, safety and health technology, or other curricula and produce an in-training level industrial hygienist or safety professional. Some academic institutions may prefer these combinations. Therefore, the tasks/activities are listed for guidance in Appendix VII and cross-referenced to each applicable task/activity and performance objective in Appendix II and Appendix III, Technical Report XI.

Tasks/Activities Designated as Graduate Level for Industrial Hygiene and Safety Professional Categories

Only a limited number of tasks/activities identified as performed in this project were designated as graduate level tasks/activities by the assignment criteria used in the project. Those that were identified are listed below by course categories and by *Industrial Hygiene* and *Safety Professional* designation.

Course	Tasks/Activities in Industrial Hygiene	Tasks/Activities in Safety Professional
Air Quality	2	2
Physical Exposures	2	1
Hazardous Materials	5	3
Flammable Materials	1	0
Materials Handling	4	4
Education/Training	3	3
Management Techniques	8	8
Evaluation and Control Methods	0	0
Mechanical and Electrical	0	0
Facilities	0	0
General	4	0
TOTAL	29	27

Twenty-one of the tasks/activities listed above were common to both the *Industrial Hygiene* and the *Safety Professional* categories. The tasks/activities designated to the Graduate level are listed in Appendix VIII.

It is possible that some of the tasks/activities designated and assigned to the Baccalaureate level are currently a part of Graduate level programs. This may be necessary because of the variety of undergraduate backgrounds of individuals who enter Graduate level education in the *Industrial Hygiene* and *Safety Professional* categories, e.g., Biological Sciences, Physical Sciences, Engineering, Management, etc.

If current Graduate level educational programs in the *Industrial Hygiene* and the *Safety Professional* categories do not include the performance of tasks/activities designated to the Baccalaureate level curricula in this project, and if the graduates are being prepared for entry level performance in industry rather than research positions, then it becomes evident that the Graduate level curricula should include many of the tasks/activities and performance objectives designated to the Baccalaureate level in this project. It should be recalled that task/activity level assignments in this project were made to the lowest level that should perform the task/activity rather than the preferred level. It is recognized that the Baccalaureate tasks/activities that are adapted to Graduate level educational programs will normally be accomplished in an accelerated educational environmental, i.e., Graduate education versus undergraduate education. Therefore, this should provide the usual opportunity for subject categories usually considered to be significantly important to occupational health and safety to be included in the Graduate curricula, e.g., toxicology, ventilation, epidemiology, biochemistry, public health, biostatistics, etc. It is also possible that the survey form used in this project was not addressed to the level of tasks/activities that Graduate school alumni normally perform. However, a large percentage of the respondents in the IH In Training, IH Professional, IH Administrator, SP In Training, SP Professional, and SP Administrator occupational levels did possess graduate degrees as indicated below.

Occupational Level	Number With Graduate Degrees	Percent With Graduate Degrees
IH In Training	79	53
IH Professional	26	46
IH Administrator	27	69
SP In Training	40	13
SP Professional	20	16
SP Administrator	16	21

It is possible that Graduate education for the *Industrial Hygiene* and the *Safety Professional* categories will experience change in the future. When Baccalaureate programs based on tasks/activities are developed, and alumni of those programs enter Graduate school, this may encourage change in present concepts of Graduate education.

Job Descriptions

Job descriptions have been developed for the eight occupational levels of interest in this project. The job descriptions, Appendix IX, have been influenced by this complete project.

SUMMARY

Tasks/activities and performance objectives were utilized in developing task-oriented curricular programs for producing qualified *Industrial Hygiene* and *Safety Professional* personnel. An Associate level curriculum has been developed for a combination Occupational Health and Safety Technician program; "certificate programs" have been developed for "occupational safety technicians" and for "occupational health technicians". It is evident that Baccalaureate curricular can be developed to produce a desired academic exposure for personnel who aspire to enter the *Industrial Hygiene* or *Safety Professional* In Training occupational level. Baccalaureate level curricula can also be developed for Occupational Health and Safety "generalist" who may qualify for the required In Training level of competence.

The Baccalaureate curricula developed in this research are designed to be separate programs for the *Industrial Hygiene* and the *Safety Professional* categories. Suggestions are also made for a combination Occupational Health and Safety "generalist"; such suggestions may be helpful in augmenting some existing programs. Graduate education, currently the most direct route to producing qualified occupational health and safety personnel, will continue to fulfill that role and will be enhanced and enriched as alumni of task/activity oriented curricula enter Graduate education programs for Industrial Hygienists and Safety Professionals.

The Job Descriptions for the *Industrial Hygiene* and the four *Safety Professional* categories, Appendix VI, indicate the responsibilities that individuals educated/trained in the suggested curricular programs should be able to perform at an acceptable level.

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CHAPTER VIII

CONCLUSIONS

Data collected from two major sources, (1) a select group of 30 Expert Practitioners and (2) a randomly selected group of 848 Incumbents, and supplementary information secured from published literature, job descriptions from State and local governments, and job descriptions from Industry have been used in the development of suggested curricula for the education and training of personnel to enter into the field of occupational health and safety. Specifically, the occupations of interest were in the *Industrial Hygiene* and *Safety Professional* categories; Technician, In Training, Professional, and Administrator.

The data were gathered through the use of an approved Task/Activity Analysis Survey Form. The data were treated statistically to determine if a task/activity was "performed" or "not performed". If performed, performance (behavioral) objectives were developed for each task/activity. The tasks/activities and performance objectives were assigned to academic levels; Associate, Baccalaureate or Graduate. Prerequisite knowledge was determined for each task/activity. Courses were then developed; they were composed of groups of related tasks/activities and performance objectives. Finally, curricula were developed.

The specific curricula developed were Associate level for Occupational Health and Safety Technician, suggested "certificate" curricula for "occupational health technician" and "occupational safety technician", Baccalaureate level for Industrial Hygiene and Baccalaureate level for Safety Professional. In addition, recommendations were made for an "occupational health and safety generalist" curriculum and suggested tasks/activities for graduate level instruction were indicated.

The tasks/activities and performance objectives developed in this project have many uses. Some of these are listed below.

1. CURRICULA
   - (a) the revision of existing curriculum
   - (b) the development of new curriculum
   - (c) the establishment of standards for the funding of education/training programs
2. ACCREDITATION
   - (a) the development of guidelines for the accreditation of curricula
3. CERTIFICATION
   - (a) the evaluation of existing certification procedures
   - (b) the establishment of new certification procedures
   - (c) the development of self-study guidelines for those who aspire to certification
4. CONTINUING EDUCATION COURSES
   - (a) the development of courses by the National Institute for Occupational Safety and Health
   - (b) the development and teaching of continuing education courses by colleges and universities
   - (c) the use of the courses in continuing education procedures that may be developed by certifying Boards

The guidance of the Project Advisory Committee (Advisory Group of Expert Consultants) has been provided throughout this project. Without that level of competent counsel, this project would be incomplete.

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APPENDIX I

Analysis of Educational and Experience Requirements for Industrial Hygiene and Safety Professional Categories at the Professional, In Training and Technician Levels for Local and State Governmental Agencies

State and local government job descriptions of *Industrial Hygiene* (IH) and *Safety Professional* (SP) occupations were analyzed for education and experience requirements. Analyses were performed to determine which occupational levels (technician, in training, and professional) were preliminary steps for other levels, and which were terminal, that is, not preliminary to another level.

Initially, 86 (43 industrial hygiene and 43 safety professional) job descriptions were analyzed for the preferred education and experience requirements. Since insufficient information was obtained from the preferred requirements alone, an alternate education and experience requirements were included. This increased the size of the education and experience requirement data units from 86 to 709. The distribution of the 709 units (N) as well as the means and standard deviations for the education and experience requirements for the industrial hygiene and safety professional occupational categories are shown in Table 1.

The values shown in Table 1 for education requirements were determined by using the following conversions:

High school diploma = 12 years
Associate degree = 14 years
Bachelor's degree = 16 years
Master's degree = 17.5 years
and Ph.D. degree = 20.5 yeras

The differences between means shown in Table 1 were tested using the t-Test with a 0.05 significance level ($\alpha = .05$). Table 2 summarizes the differences between mean years of required education and the differences between mean years of required experience. From Table 2 it is seen that there is no significant difference between the years of education required of the IH Professional and SP Professional or between the years required of the IH Technician and SP Technician. There is, however, a significant difference between the years of education required of the IH In Training (16.75) and the SP In Training (14.18).

It is also observed from Table 2 that the number of years experience required of the same occupational level (technician, in training, professional) for the two groups (IH and SP) is different. Thus, the required experience of the IH Professinal (5.55 years) is significantly different from the required experience of the SP Professional (4.81 years). Likewise, the SP In Training (4.86) is significantly different from the IH In Training (2.07), and the IH Technician (5.65) is significantly different from the SP Technician (2.51).

To determine if any relationship exists between required education and required experience within the occupational categories, linear correlation and regression analyses were performed. Table 3 summarizes the correlation and regression analyses. It is seen from Table 3 that there is no significant relationship ($r = 0$) between required years of education and required years of experience for the IH Professional, IH In Training, and SP Professional occupational categories. Although the remainder of the occupational categories (IH Technician, SP In Training, and SP Technician) yielded correlation coefficients significantly different from zero, the low values of r^2 indicate "weak" regression equations. That is, since the value of r^2 (e.g., .35) indicates the amount of variance in Y (i.e., required years of experience for the IH Technician), it is apparent that 65 percent (1.00 - 0.35) of the variance in Y is not explained by X. Thus, since other undetermined variables greatly influence the required education stipulated in the job descriptions, the regression equation coefficients in Table 3 are of limited value.

Table 4 summarizes the relationships of education and experience requirements for the Industrial Hygiene occupational levels. From Table 4 it is seen that:

(1) the Technician level differs from the In Training and Professional levels in education (i.e., Technician requires a mean of 4 years less education); and differs from the In Training level in experience (i.e., Technician requires a mean of about 3.5 years more experience).

(2) the In Training level does not differ from the professional level in education, but does differ in experience (i.e., In Training requires a mean of about 3.5 years less experience).

(3) the Professional level does not differ from the In Training level in education or from the Technician level in experience.

Thus, it may be concluded that the IH In Training level is a preliminary step to the terminal IH Professional level since the only difference between them is the 3.5 years more experience for the Professional. The IH Technician level appears to be a terminal level since the mean years of education is 4 years less and the mean years of experience 3.5 years more than the IH In Training level. This does not preclude the opportunity for the Technician from reaching the other levels by obtaining the necessary education.

Table 5 summarizes the relationships of education and experience requirements for the Safety Professional occupational levels. From Table 5 it is seen that:

(1) the Technician level differs from both the In Training and Professional levels in education (i.e., Technical requires about 1 year less than In Training and about 3 years less than Professional), and in experience (i.e., Technical requires about 2.5 years less than In Training and Professional).

(2) the In Training level differs from the Professional level in education (i.e., In Training requires about 2 years less than professional), but not in experience (i.e., both require about 5 years).

(3) the Professional level requires more education than both the In Training and Technician levels, but requires the same experience as the In Training level.

Thus, it may be concluded that the SP In Training level is a preliminary step to the terminal SP Professional level since the only difference between them is the approximately 2 years more education for the Professional. The SP Technician level may be considered a preliminary step to the In Training level for it requires both more education (about 1 year) and more experience (about 2.5 years) to step from the Technician to the In Training level.

Table 1. Years of Education and Experience Requires for State and Local Government Industrial Hygiene and Safety Professional Occupations

Occupational Category	N	Required Education Mean	Required Education Stnd. Dev.	Required Experience Mean	Required Experience Stnd. Dev.
Industrial Hygiene					
Professional	69	16.35	1.92	5.65	1.35
In Training	304	16.75	1.26	2.07	1.39
Technician	20	12.50	1.10	5.65	2.94
Safety Professional					
Professional	42	16.25	0.48	4.81	1.43
In Training	202	14.18	1.97	4.86	3.01
Technician	72	12.94	1.09	2.51	1.11

Table 2. Comparison of the Mean Years of Required Education and Mean Years of Required Experience for the State and Local Government Industrial Hygiene and Safety Professional Occupational Categories

Occupational Category	Mean Required Education (Years)*	Occupational Category	Mean Required Experience (Years)*
IH In Training	16.75	IH Professional	5.65
IH Professional	16.35	IH Technical	5.65
SP Professional	16.25	SP In Training	4.86
SP In Training	14.18	SP Professional	4.81
SP Technician	12.94	SP Technician	2.51
IH Technician	12.50	IH In Training	2.07

*Note: means connected by a common line are not significantly different ($\alpha = .05$)

Table 3. Summary of Linear Correlation and Regression Analyses Between Required Years of Education (Y) and Required Years of Experience (X)

Occupational Category	Product-Momemt Correlation Coefficient (r)	Product-Momemt Correlation Coefficient (r^2)	Linear Regression Coefficients slope	Linear Regression Coefficients Y-intercept
Industrial Hygiene:				
Professional	0.10	0.01	---	-----
In Training	0.00	0.00	---	-----
Technician	-0.59*	0.35	-0.22	13.75
Safety Professional:				
Professional	0.10	0.01	---	-----
In Training	-0.58*	0.34	-0.38	16.03
Technician	-0.55*	0.30	0.54	14.29

*r is significantly different from zero, $\alpha = .01$

Table 4. Summary of Safety Professional Education and Experience Requirements

Occupational Level	Mean Required Education (years)	Mean Required Experience (years)
Professional	16.25	4.81 *
In Training	14.18	4.86 *
Technician	12.94	2.51

*not significantly different

Table 5. Summary of Industrial Hygiene Education and Experience Requirements

Occupational Level	Mean Required Education (years)	Mean Required Experience (years)
Professional	16.35 *	5.65 **
In Training	16.75 *	2.07
Technician	12.50	5.65 **

*not significantly different
**not significantly different

APPENDIX II

Task/Activity Analysis Survey Form
- (1) Task/Activity Checklist
- (2) Personal Background
- (3) Tasks/Activities

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TASK/ACTIVITY CHECKLIST

INTRODUCTION

Texas A&M University, under contract with the National Institute for Occupational Safety and Health, has responsibility for the development of task-related curricula for the education/training of individuals entering into industrial hygiene and the safety profession. In addition, the contract requires the verification of current certification procedures for those employed in these two professions.

You have been selected to participate in this project because of your specific background and expertise. Your participation will assure that your years of experience and knowledge will contribute to and be included in future concepts pertaining to the education/training of individuals entering the ranks of industrial hygienists and safety professionals.

As a part of the performance of this contract, the attached task/activity checklists have been developed. The major purpose of the checklists is to assist in collecting data which will help to define the tasks/activities which are performed within the professions. The individual responses to this checklist will remain confidential and be used for research purposes only. All data will be grouped together for computer tabulation and study with full confidentiality assured each participant.

Your response to this checklist is essential. Without the cooperation of you and your colleagues, such a study is impossible. Your contribution of time and knowledge will be beneficial to those who will enroll in training/education programs to enter these professions in the future. A paramount interest is to assure that those individuals are provided the most relevant education and training opportunities possible. This, in turn, will aid in assuring that those who enter your profession will continue your efforts in the future.

INSTRUCTIONS

The checklist is divided into three separate sections:

A. Background Data
B. Task/Activity Checklist
C. Task/Activity by Type Exposure Checklist

Each question/statement should be answered as it applies to YOU in your current position (for example, Do YOU personally analyze accident/injury reports?).

A. Background Data

Check or complete the response to each question which best describes YOUR CURRENT POSITION. This data will be used to group responses for statistical study.

B. Task/Activity Checklist (Pages 3-19)

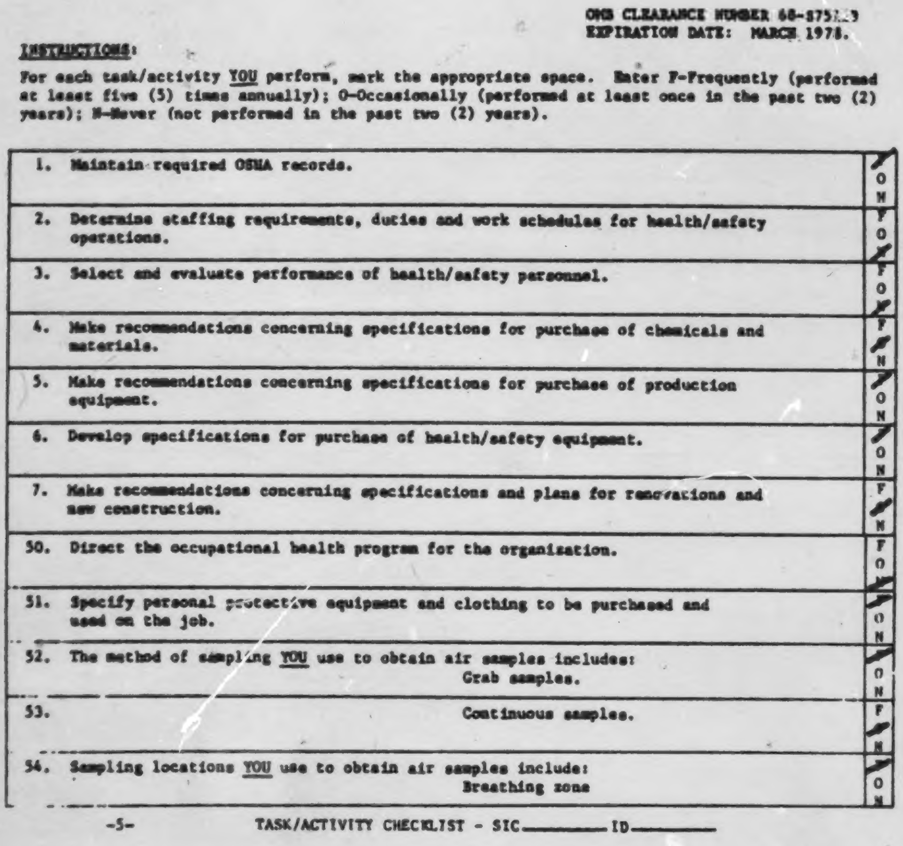
The questions and/or statements in this section are designed to indicate the frequency with which YOU perform a task or activity. Indicate your response by placing a diagonal mark over the appropriate response (F,O,N) as defined below.

The frequency with which YOU perform a task/activity should be determined using the following definitions:

1. Frequently - performed a minimum of five (5) times annually.
2. Occasionally - performed at least once in the past two (2) years.
3. Never - has not been performed by YOU in the past two (2) years.

The following example serves to indicate the method which should be used in responding to this section.

EXAMPLE I



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INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

1. Maintain required OSHA records.	[✓ F] O N
2. Determine staffing requirements, duties and work schedules for health/safety operations.	F O [✓ N]
3. Select and evaluate performance of health/safety personnel.	F O [✓ N]
4. Make recommendations concerning specifications for purchase of chemicals and materials.	F [✓ O] N
5. Make recommendations concerning specifications for purchase of production equipment.	[✓ F] O N
6. Develop specifications for purchase of health/safety equipment.	[✓ F] O N
7. Make recommendations concerning specifications and plans for renovations and new construction.	F [✓ O] N
50. Direct the occupational health program for the organization.	F O [✓ N]
51. Specify personal protective equipment and clothing to be purchased and used on the job.	[✓ F] O N
52. The method of sampling YOU use to obtain air samples includes: Grab samples.	[✓ F] O N
53. Continuous samples.	F [✓ O] N
54. Sampling locations YOU use to obtain air samples include: Breathing zone	[✓ F] O N

-5- TASK/ACTIVITY CHECKLIST - SIC________ ID________

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C. Task/Activity by Type Exposure Checklist (Pages 20-25)

Note that this section of the checklist is arranged by task/activities and type of exposure. Each task/activity statement represents a function which YOU may perform in YOUR current position. The task/activity may be performed by YOU within the seven (7) types of exposures that have been selected, (1) air quality, (2) physical, (3) hazardous materials, (4) flammable materials, (5) material handling, (6) mechanical and electrical, and (7) facilities. For each task/activity in each type of exposure, different levels of performance may exist and these can be indicated by the frequency which a task/activity may be performed in any one or more type of exposure. This performance is indicated by frequently (F), occasionally (O), and never (N).

For each task/activity which YOU perform for a given type of exposure in YOUR CURRENT POSITION, place a diagonal mark over the F, O, or N indicating the frequency of YOUR activity. If you have been in your current position for a period greater than two (2) years, indicate only those task/activities which YOU have performed in the types of exposures within the last two (2) years and for the level of activity which YOU consider appropriate.

In completing the Task/Activity checklist, your response should be guided by the following "types of exposure" definitions. (It is assumed that the exposure may exist in the workplace or in the community as a result of the organizations operations.)

1. Air Quality - harmful materials (gases, vapors, fumes, mists, dusts, and particulate matter) which are airborne health hazards.
2. Physical Exposure - noise, vibration, temperature, ionizing and non-ionizing radiation and abnormal pressures.
3. Hazardous Materials - liquid and solid substances which have harmful effects on persons.
4. Flammable Materials - gases, vapors, dusts, liquids, and solids which result in fire and explosion.
5. Materials Handling - manual (lifting, pushing, pulling, stacking, etc.), mechanical (fork truck, cranes, conveyors, elevators, etc.), and transportation systems.
6. Mechanical and Electrical - point-of-operation, mechanical power transmission (belts, pulleys, etc.), electrical bonding and grounding, electrical shock, etc.
7. Facilities - buildings, grounds, walking and working surfaces, utilities (water, gas, electric, steam, etc.).

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It is essential that YOU respond to each task/activity listed, that is mark either F, O, or N for each type of exposure in which YOU function. The following example serves to indicate the method which should be used in responding to this section.

EXAMPLE II

INSTRUCTIONS

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For each task/activity YOU perform related to each type of exposure, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

	TYPE OF EXPOSURE						
TASKS/ACTIVITIES	Air Quality	Physical	Hazardous Materials	Flammable Materials	Material Handling	Mechanical & Electrical	Facilities
292. Conduct walk through inspections to identify potential hazards.	[✓ F] O N	[✓ F] O N	[✓ F] O N	F [✓ O] N	F [✓ O] N	F O [✓ N]	F [✓ O] N
293. Observe workers performing specific operations or jobs to identify potential hazards.	F [✓ O] N	F [✓ O] N	F [✓ O] N	F O [✓ N]	[✓ F] O N	F [✓ O] N	F [✓ O] N
294. Obtain samples or data for identification of or measurements of the extent of a potential hazard.	[✓ F] O N	[✓ F] O N	[✓ F] O N	F [✓ O] N	F [✓ O] N	F O [✓ N]	F [✓ O] N
295. Review accident or injury reports to identify potential hazards and/or analyze for potential cause.	F [✓ O] N	F [✓ O] N	F [✓ O] N	F O [✓ N]	F [✓ O] N	F O [✓ N]	F O [✓ N]
296. Review facility plans, process plans, specifications and drawings to identify potential hazards and/or to analyze for potential cause.	F [✓ O] N	F [✓ O] N	F [✓ O] N	F O [✓ N]	F [✓ O] N	F O [✓ N]	F O [✓ N]
297. Review written job procedures, methods and practices to identify potential hazards and/or analyze for potential cause.	F [✓ O] N	F [✓ O] N	[✓ F] O N	F O [✓ N]	F [✓ O] N	F O [✓ N]	F O [✓ N]
298. Select the area of operation to be inspected.	[✓ F] O N	[✓ F] O N	F [✓ O] N	F O [✓ N]	F O [✓ N]	F O [✓ N]	F O [✓ N]
299. Select appropriate equipment to use when sampling or collecting data.	[✓ F] O N	[✓ F] O N	F [✓ O] N	F O [✓ N]	F O [✓ N]	F O [✓ N]	F O [✓ N]

THANK YOU FOR YOUR PARTICIPATION IN THIS PROJECT.

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PERSONAL BACKGROUND

(Background Data)

SIC ____

ID ____

1. Location Zip Code ________

2. Age ________

3. Which of the following best describes your present responsibilities:

Industrial Hygiene Director/Mgr.	____01
Safety Director/Manager	____02
Loss Prevention & Control Mgr.	____03
Industrial Hygienist	____04
Safety Engineer	____05
Industrial Hygiene Technician	____06
Safety Technician	____07
Safety Inspector	____08
Compliance Officer	____09
Other	____10

Specify ____________

4. Your responsibility level (mark only one)

Industrial Hygiene	
Total Organization	____01
Region or Group of Locations	____02
Single Site	____03
Consulting	____04
Safety	
Total Organization	____05
Region or Group of Locations	____06
Single Site	____07
Consulting	____08
Both Industrial Hygiene and Safety	
Total Organization	____09
Region or Group of Locations	____10
Single Site	____11
Consulting	____12

5. Years in current position (enter nearest whole number) ________

6. Years with current employer ________

7. Total years full-time work experience ________

8. Highest academic level achieved (mark only one)

Less than high school	____01
High school diploma	____02
Some college, no degree	____03
Associate degree	____04
Bachelor's degree	____05
Graduate study, no degree	____06
Master's degree	____07
Doctorate	____08

9. Major college course of study (indicate by checking the appropriate column for each degree in each discipline):

A - Associate
B - Bachelor's
M - Master's
D - Doctorate

	A	B	M	D
Industrial Hygiene	__	__	__	__
Safety Engineering	__	__	__	__
Engineering (Other disciplines)	__	__	__	__
Basic Science	__	__	__	__
Business Administration	__	__	__	__
Liberal Arts	__	__	__	__
Education	__	__	__	__
Medicine	__	__	__	__
Other	__	__	__	__

10. Year last degree earned ________

11. Certification or Registration held:

American Board of Industrial Hygiene (ABIH)	________
Board of Certified Safety Professionals (BCSP)	________
ABIH in training	________
BCSP in training	________
State Industrial Hygiene Certification	________
State Safety Certification	________
Environmental Engineering Society	________
Intersociety Board	________
Professional Engineer	________
Other	________

Specify ____________

12. ABIH Specialty

Comprehensive Practice	________
Engineering Aspects	________
Chemical Aspects	________
Toxicological Aspects	________
Radiological Aspects	________
Air Pollution Aspects	________
Acoustical Aspects	________

13. AIHA Member Classification

Professional	____01
Affiliate	____02
Fellow	____03
Emeritus	____04

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14. ASSE Member Classification

Professional	______	01
Affiliate	______	02
Fellow	______	03
Emeritus	______	04

15. ACGIH Member Classification

Member	______	01
Associate	______	02

16. If your duties are limited to one of the following specialties, please indicate by checking the appropriate area:

Toxicology	______	01
Health Physics	______	02
Air Pollution	______	03
Acoustical (noise control)	______	04
Safety Engineering Design	______	05
Waste Management	______	06
Chemical Safety	______	07
Laboratory Analysis	______	08
Product Safety	______	09
Safety Inspection	______	10
Accident Reconstruction	______	11
Plant First Aid	______	12
System Safety	______	13
Other	______	14

Specify ____________________________

17. How many employees of each of the following categories do you directly supervise?

Industrial Hygienist ______
Safety Professional ______
Industrial Hygienist in Training ______
Safety Professional in Training ______
Industrial Hygiene Technician ______
Safety Technician ______
Fire Protection Engineer ______
Medical (R.N., L.P.N., etc.) ______
Other ______
Specify ____________________________

18. Approximate percent of your time which is spent in different areas. (Enter the estimated % of time you spend in each area.)

Industrial Hygiene ______
Safety ______
Plant or Organization Personnel ______
Engineering ______
Other ______
Specify ____________________________

19. Of the total time you spend working in Industrial Hygiene and/or Safety, what percent is spent in each of the following activities:

	%
Identification of hazards	______
Measurement of hazard extent	______
Analysis of hazard	______
Development of alternate controls	______
Design of equipment or controls	______
Fire protection and control	______
Presentations (include preparation)	______
Written reports	______
Training	______
Attending meetings	______
Planning programs	______
Supervising workers	______

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INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

1.	Maintain required OSHA records.	F O N
2.	Determine staffing requirements, duties and work schedules for health/safety operations.	F O N
3.	Select and evaluate performance of health/safety personnel.	F O N
4.	Make recommendations concerning specifications for purchase of chemicals and materials.	F O N
5.	Make recommendations concerning specifications for purchase of production equipment.	F O N
6.	Develop specifications for purchase of health/safety equipment.	F O N
7.	Make recommendations concerning specifications and plans for renovations and new construction.	F O N
8.	Make recommendations concerning new production processes planned.	F O N
9.	Maintain and tabulate injury report records by computer.	F O N
10.	Use cost/benefit analysis techniques to compare alternative control methods.	F O N
11.	Prepare periodic written reports to management concerning health and safety activities and experiences.	F O N
12.	Develop plans for overall health and safety program of the organization.	F O N
13.	Direct the implementation of the overall health and safety program of the organization.	F O N
14.	Organize health and safety committees.	F O N
15.	Direct health and safety committee activities.	F O N
16.	Conduct health and safety committee meetings.	F O N
17.	Make formal presentations to groups: management, safety committees, professional societies, unions, civic clubs, etc.	F O N
18.	Develop health and safety training programs.	F O N

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INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

19.	Conduct health and safety training sessions.	F O N
20.	Develop off-the-job safety training programs.	F O N
21.	Plan and conduct campaigns for improved health and safety.	F O N
22.	Administer the workmen's compensation program.	F O N
23.	Coordinate injury (claim) settlement.	F O N
24.	Administer the liability insurance program.	F O N
25.	Plan periodic medical examinations for workers in conjunction with medical personnel.	F O N
26.	Prepare the budget for health/safety operations.	F O N
27.	Plan the location of, equipment for and staff of emergency and disaster operations centers.	F O N
28.	Conduct first-aid training for employees.	F O N
29.	Make recommendations concerning specifications and design of products produced by your organization.	F O N
30.	Make recommendations concerning procedures, layout and equipment used in offices within your organization.	F O N
31.	Make recommendations concerning procedures, layout and equipment used in laboratories within your organization.	F O N
32.	Produce a health/safety newsletter for distribution to employees.	F O N
33.	Interview supervision concerning hazards on the job.	F O N
34.	Interview the employee or employee's representative concerning hazards on the job.	F O N
35.	Contact personnel at other locations or firms to gather data concerning their health/safety experiences.	F O N
36.	Contact insurance carriers and/or associations (ASSE, AIHA, ACGIH, etc.) to gather information on health/safety experiences.	F O N

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INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

37.	Administer a total loss control program for the organization.	F O N
38.	Participate in product design review.	F O N
39.	Make recommendations concerning product data sheets, operating and assembly instructions, etc., for products produced.	F O N
40.	Develop standards for the organization's product safety program.	F O N
41.	Review customer complaints concerning product hazards.	F O N
42.	Respond to customer complaints concerning product hazards.	F O N
43.	Represent the organization in contact with the community and government concerning environmental influences of operations.	F O N
44.	Calculate indices such as frequency rate, severity rate, average days charged, total cost/accident, etc.	F O N
45.	Analyze the health history of new or transferred employees to determine if the potential for health problems may exist.	F O N
46.	Analyze the results of such items as physical examinations, biochemical monitoring and audiometric tests, in conjunction with medical personnel.	F O N
47.	Maintain records on individual employee exposures.	F O N
48.	Maintain records on individual employee injuries.	F O N
49.	Measure the worker's physiological condition while at work, in conjunction with medical personnel.	F O N
50.	Direct the occupational health program for the organization.	F O N
51.	Specify personal protective equipment and clothing to be purchased and used on the job.	F O N
52.	The method of sampling YOU use to obtain air samples includes: Grab samples.	F O N
53.	Continuous samples.	F O N
54.	Sampling locations YOU use to obtain air samples include: Breathing zone	F O N

INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

55.		General work area	F O N
56.		Point of operation	F O N
57.		Air handling ducts	F O N
58.		Stacks	F O N
59.		Community environment	F O N
60.		Other Specify ______________________________	F O N
61.	The method of analysis YOU use to determine the results of air quality monitoring:	Direct reading instruments	F O N
62.		In-house laboratory	F O N
63.		Commercial laboratory	F O N
64.		Other Specify ______________________________	F O N
65.	Methods YOU use to gather and/or analyze air samples:	Absorption	F O N
66.		Adsorption	F O N
67.		Electrical conductivity	F O N
68.		Heat of combustion	F O N
69.		Interferometery	F O N
70.		Spectrum absorption	F O N
71.		Thermal conductivity	F O N
72.		Chromatography	F O N

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INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

73.	Colorimetry	F O N
74.	Flame ionization	F O N
75.	Impingment	F O N
76.	Filtration	F O N
77.	Gravimetric	F O N
78.	Gas scrubber	F O N
79.	X-ray diffraction	F O N
80.	Other Specify ______________________________	F O N
81.	Types of equipment YOU use for air quality surveys: Direct reading colorimetric	F O N
82.	Halide meter	F O N
83.	Mercury vapor tester	F O N
84.	Elutriator	F O N
85.	Cyclone separator	F O N
86.	Impinger	F O N
87.	Personal sampler	F O N
88.	Combustible gas detector	F O N
89.	Cascade impactor	F O N
90.	Membrane filter	F O N

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INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

91.	Air pump	F O N
92.	Aerosol light scattering	F O N
93.	Thermal precipitator	F O N
94.	Electrostatic precipitator	F O N
95.	Charcoal tube	F O N
96.	Other Specify ________________________	F O N
97. Types of equipment which YOU calibrate:	Direct reading colorimetric	F O N
98.	Halide meter	F O N
99.	Mercury vapor tester	F O N
100.	Elutriator	F O N
101.	Cyclone separator	F O N
102.	Impinger	F O N
103.	Personal sampler	F O N
104.	Gas chromatograph	F O N
105.	Combustible gas detector	F O N
106.	Cascade impactor	F O N
107.	Air pump with membrane filter	F O N
108.	Air pump with charcoal tubes	F O N

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INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F–Frequently (performed at least five (5) times annually); O–Occasionally (performed at least once in the past two (2) years); N–Never (not performed in the past two (2) years).

109.	Aerosol light scattering	F O N
110.	Other Specify ____________________	F O N
111. In reference to ventilation systems, do YOU:	Use coefficients of entry	F O N
112.	Use the equivalent foot method or velocity pressure method for design	F O N
113.	Specify air cleaners	F O N
114.	Specify fans	F O N
115.	Design exhaust hoods	F O N
116.	Calculate make-up air requirements	F O N
117.	Specify the location of exhaust ducts	F O N
118.	Use psychometric charts	F O N
119.	Use velometers	F O N
120.	Use manometers	F O N
121. Do YOU perform instrument calibrations using:	Spirometer	F O N
122.	Bubble buret	F O N
123.	Wet test meter	F O N
124.	Dry gas meter	F O N
125.	Venturi meter	F O N
126.	Rotameter	F O N

INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

127.	Other Specify ____________________	F O N
128. Do YOU perform instrument calibrations using:	Static concentrations	F O N
129.	Dynamic concentrations	F O N
130. Do YOU perform audiometric tests on workers using:	Pure tone threshold	F O N
131.	Pure tone screening	F O N
132.	Speech audiometry	F O N
133.	Automatic audiometry	F O N
134. Noise and vibration measurement equipment YOU use:	Sound level meter	F O N
135.	Octave band analyzer	F O N
136.	Impact noise analyzer	F O N
137.	Graphic level recorder	F O N
138.	Tape recorder	F O N
139.	Calibration sound source	F O N
140.	Noise dosimeter	F O N
141.	Vibration analyzer	F O N
142.	Other Specify ____________________	F O N
143. Types of noise measurement equipment YOU calibrate:	Sound level meter	F O N
144.	Octave band analyzer	F O N

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INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

145.	Impact noise analyzer	F O N
146.	Graphic level recorder	F O N
147.	Tape recorder	F O N
148.	Calibration sound source	F O N
149.	Noise dosimeter	F O N
150.	Vibration analyzer	F O N
151.	Audiometers	F O N
152.	Other Specify ______________________________	F O N
153.	Do YOU design noise isolation enclosures?	F O N
154.	Do YOU determine workers total noise exposures?	F O N
155.	Do YOU specify sound absorption materials?	F O N
156.	Do YOU design vibration isolation systems?	F O N
157.	Do YOU develop procedures for community noise control?	F O N
158.	Do YOU develop noise contours?	F O N
159.	Do YOU develop and implement a hearing conservation program?	F O N
160.	Do YOU monitor radiation levels in the vicinity of operations involving: Electron tubes	F O N
161.	Lasers	F O N
162.	X-ray equipment	F O N

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INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

163.	Fluroscopic installations	F O N
164.	X-ray diffraction	F O N
165.	Electron microscopes	F O N
166.	Radioactive static eliminators	F O N
167.	Nuclear reactors	F O N
168.	Microwave equipment	F O N
169.	Neutron generators	F O N
170.	Tracer materials	F O N
171.	Ultraviolet equipment	F O N
172.	Other Specify ______________________	F O N
173. When monitoring radiation levels, do YOU use:	Geiger Counter	F O N
174.	Film badge	F O N
175.	Dosimeter	F O N
176.	Activation devices	F O N
177.	Ionization chamber	F O N
178.	Proportional counter	F O N
179.	Scintillation counter	F O N
180.	Other Specify ______________________	F O N

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INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

181.	Do YOU evaluate radiation hazards involving the following:	Waste handling	F O N
182.		Waste disposal	F O N
183.		Transport of materials	F O N
184.		Storage of materials	F O N
185.		Accidental spillage	F O N
186.		Equipment malfunction	F O N
187.		Worker error	F O N
188.		Static elimination	F O N
189.		Transfer of source	F O N
190.		Other Specify ______________________	F O N
191.	Do YOU act as the interface between your organization and groups such as the AEC?		F O N
192.	In reference to abnormal pressures do YOU:	Identify	F O N
193.		Measure	F O N
194.		Analyze/evaluate	F O N
195.		Recommend controls	F O N
196.	In reference to biological hazards do YOU:	Identify	F O N
197.		Measure	F O N
198.		Analyze/evaluate	F O N

OMB CLEARANCE NUMBER 68-S75129
EXPIRATION DATE: MARCH 1978.

INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

199.	Recommend controls	F O N
200.	Do YOU become involved in thermal exposure problems (heat, cold, rapid change in temperature)?	F O N
201.	Equipment which YOU use to measure thermal exposure includes: Dry bulb thermometer	F O N
202.	Wet bulb thermometer	F O N
203.	Globe thermometer	F O N
204.	Hygrometer	F O N
205.	Air velocity instruments	F O N
206.	Other Specify ______________________	F O N
207.	Do YOU make recommendations concerning the storage and handling of hazardous materials within the plant?	F O N
208.	Do YOU make recommendations concerning the transportation of hazardous materials outside the plant?	F O N
209.	Do YOU develop, organize and implement fire protection and prevention plans?	F O N
210.	Do YOU direct fire protection and prevention activities?	F O N
211.	Do YOU direct the activities of a fire protection specialist?	F O N
212.	Do YOU perform the activities of a fire protection specialist?	F O N
213.	Do YOU develop specifications for the purchase of major fire fighting equipment?	F O N
214.	Do YOU train fire fighting brigades?	F O N
215.	Do YOU develop specifications for the purchase of or installation of localized fire protection equipment such as extinguishers, detection systems, sprinklers, etc.?	F O N
216.	Do YOU implement procedures for appropriate inspection and maintenance of fire protection and control equipment?	F O N

INSTRUCTIONS:

For each task/activity YOU perform, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

217.	The types of storage for which YOU have safety responsibility includes: Pallet storage	F O N
218.	Bin storage	F O N
219.	Automated warehouse	F O N
220.	Bulk storage tanks	F O N
221.	Other Specify ______________	F O N
222.	Do YOU identify and/or control material handling and transportation hazards relative to: Conveyor systems	F O N
223.	Powered industrial trucks	F O N
224.	Elevators	F O N
225.	Hoists and cranes	F O N
226.	Railways	F O N
227.	Over-the-road vehicles	F O N
228.	Aircraft	F O N
229.	Seagoing vessels	F O N
230.	River vessels and barges	F O N
231.	Pipelines	F O N
232.	Other Specify ______________	F O N
233.	In reference to manual material handling hazards (ergonomic exposures) do YOU: Identify	F O N
234.	Measure	F O N

OMB CLEARANCE NUMBER 68-S75129
EXPIRATION DATE: MARCH 1978.

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235.	Analyze/evaluate	F O N
236.	Recommend controls	F O N
237.	Do YOU establish inspection schedules for material handling equipment?	F O N
238.	Do YOU approve designs for shop-made material handling equipment and devices?	F O N
239.	Do YOU establish safe load factors for material handling and transportation equipment?	F O N
240.	Do YOU design or redesign point of operation guards for mechanical equipment?	F O N
241.	Do YOU recommend that hazardous equipment be removed from operation?	F O N
242.	Equipment which YOU use to evaluate mechanical and electrical hazards includes: Ammeter, ohm meter, volt meter	F O N
243.	Thermocouple	F O N
244.	Strobe light	F O N
245.	Pressure gauges	F O N
246.	Temperature gauges	F O N
247.	Ground fault indicator	F O N
248.	Tachometer	F O N
249.	Strain gauges	F O N
250.	Other Specify ______________________________	F O N
251.	Do YOU review maintenance schedules to determine if adequate to assure that equipment will operate safely?	F O N
252.	Do YOU review maintenance schedules and procedures to identify hazardous situations for maintenance personnel?	F O N

OMB CLEARANCE NUMBER 68-S75129
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253.	Do YOU identify and/or control hazards in maintenance shop areas?	F O N
254.	Do YOU make recommendations concerning electrical distribution systems?	F O N
255.	Do YOU use ergonomic principles to modify or design work methods, procedures or workplace layouts?	F O N
256.	In reference to the following site facilities, do YOU evaluate and/or recommend controls related to: Renovation of facilities	F O N
257.	New construction	F O N
258.	Water systems	F O N
259.	Illumination	F O N
260.	Heating and cooling	F O N
261.	Boiler installations	F O N
262.	Steam distribution	F O N
263.	Structural loads	F O N
264.	Grounds, yards and parking	F O N
265.	Waste treatment	F O N
266.	Solid waste disposal	F O N
267.	Electrical distribution systems	F O N
268.	Entry and egress routes	F O N
269.	In-plant traffic patterns	F O N
270.	Roadway maintenance	F O N

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271.	Snow removal	F O N
272.	Walking and working surfaces	F O N
273.	Do YOU determine the need for employee health/safety training?	F O N
274.	Do YOU determine the content to be included in health/safety training?	F O N
275.	Do YOU develop the course content and materials to be offered for health/safety training?	F O N
276.	Do YOU develop audio-visual materials to be used in health/safety training?	F O N
277.	Do YOU conduct classroom training sessions?	F O N
278.	Do YOU develop evaluation methods (tests, etc.) to be used in conjunction with health/safety training?	F O N
279.	The types, modes and/or locations of employee education/training which YOU use includes: Indoctrination training	F O N
280.	Entry level training	F O N
281.	Trade association materials	F O N
282.	Rule books, safety manuals	F O N
283.	Trade association courses	F O N
284.	Colleges or universities	F O N
285.	Programmed learning materials	F O N
286.	Public display materials (posters, banners, etc.)	F O N
287.	Buddy system training	F O N
288.	Specific job training	F O N

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289.	NIOSH sponsored courses	F O N
290.	OSHA sponsored courses	F O N
291.	Other Specify ______________________	F O N
		F O N
		F O N
		F O N
		F O N
		F O N
		F O N
		F O N
		F O N
		F O N
		F O N
		F O N
		F O N
		F O N
		F O N
		F O N

TASK/ACTIVITY CHECKLIST - SIC________ ID________

OMB CLEARANCE NUMBER 68-S75129
EXPIRATION DATE: MARCH 1978

INSTRUCTIONS

For each task/activity YOU perform related to each type of exposure, mark the appropriate space. Enter F-Frequently (performed at least five (5) times annually); O-Occasionally (performed at least once in the past two (2) years); N-Never (not performed in the past two (2) years).

TASKS/ACTIVITIES	TYPE OF EXPOSURE						
	Air Quality	Physical	Hazardous Materials	Flammable Materials	Material Handling	Mechanical & Electrical	Facilities
292. Conduct walk through inspections to identify potential hazards.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
293. Observe workers performing specific operations or jobs to identify potential hazards.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
294. Obtain samples or data for identification of or measurements of the extent of a potential hazard.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
295. Review accident or injury reports to identify potential hazards and/or analyze for potential cause.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
296. Review facility plans, process plans, specifications and drawings to identify potential hazards and/or to analyze for potential cause.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
297. Review written job procedures, methods and practices to identify potential hazards and/or analyze for potential cause.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
298. Select the area of operation to be inspected.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
299. Select appropriate equipment to use when sampling or collecting data.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
300. Select the location(s) where sampling data collection or monitoring is to take place.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
301. Select the time schedule or time period to be used for sampling, data collection or monitoring.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
302. Take still photographs, motion pictures or video tape of work operations to identify potential hazards.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
303. Analyze photographs, motion pictures or videotapes to develop improvements in work methods.	F O N	F O N	F O N	F O N	F O N	F O N	F O N

TASK/ACTIVITY by Type Exposure Checklist. SIC________ ID________

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		TYPE OF EXPOSURE						
	TASKS/ACTIVITIES	Air Quality	Physical	Hazardous Materials	Flammable Materials	Material Handling	Mechanical & Electrical	Facilities
304.	Make engineering drawings or sketches of equipment or layouts.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
305.	Investigate injuries to prepare technical reports.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
306.	Investigate property damage accidents to prepare technical reports.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
307.	Investigate noninjury, nonproperty damage accidents to prepare technical reports.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
308.	Review specifications for existing production equipment to identify potential hazards.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
309.	Review specifications for existing materials and/or chemicals to identify potential hazards.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
310.	Request tests of production equipment materials to determine if hazards are present.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
311.	Develop or modify emergency procedures for accidents, injuries, spills, fires, etc.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
312.	Review applicable codes and/or recommend standards to determine compliance.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
313.	Analyze and interpret the results of injury or accident investigations, reports and inspections to determine if corrective action is required.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
314.	Perform laboratory analysis of samples to identify or measure the extent of a potential hazard.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
315.	Analyze and interpret the results of sampling or monitoring to determine if corrective action is necessary.	F O N	F O N	F O N	F O N	F O N	F O N	F O N

TASK/ACTIVITY by Type Exposure Checklist. SIC________ ID________

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TYPE OF EXPOSURE

	TASKS/ACTIVITIES	Air Quality	Physical	Hazardous Materials	Flammable Materials	Material Handling	Mechanical & Electrical	Facilities
316.	Perform calculations necessary to determine if acceptable levels or limits of exposure have been exceeded.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
317.	Prepare and maintain control charts (rolling averages, cumulative, etc.) to determine if nonrandom influences are affecting performance.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
318.	Supervise personnel who are responsible for identification and recognition of potential hazards.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
319.	Supervise personnel who are responsible for measurement of potential hazard exposure.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
320.	Supervise personnel who are responsible for analysis and evaluation of potential hazard exposure.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
321.	Supervise personnel who are responsible for establishing or implementing controls for hazard exposure.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
322.	Use corporate staff specialists to assist in the evaluation and/or control of hazard exposure.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
323.	Use outside consultant specialists to assist in the evaluation and/or control of hazard exposure.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
324.	Request tests of equipment and/or protective devices to determine if controls are operating.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
325.	Use fault tree analysis.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
326.	Use failure mode and effect analysis to identify potential hazards.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
327.	Use the critical incident technique method of analysis to identify potential hazards.	F O N	F O N	F O N	F O N	F O N	F O N	F O N

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TASKS/ACTIVITIES	TYPE OF EXPOSURE						
	Air Quality	Physical	Hazardous Materials	Flammable Materials	Material Handling	Mechanical & Electrical	Facilities
328. Use work sampling techniques.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
329. Develop alternate solutions applicable to control an identified hazard.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
330. Make recommendations concerning the most appropriate solution(s) to be implemented.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
331. Approve the recommended solution(s) and initiate implementation.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
332. Direct the implementation of the recommended solution(s).	F O N	F O N	F O N	F O N	F O N	F O N	F O N
333. Perform follow-up monitoring, inspections, etc., to determine the effectiveness of the solution(s).	F O N	F O N	F O N	F O N	F O N	F O N	F O N
334. Recommend or introduce changes for control of hazards such as: Process changes.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
335. Procedure changes.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
336. New equipment.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
337. Chemical or material substitution.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
338. Engineering changes to equipment.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
339. Personal protective equipment.	F O N	F O N	F O N	F O N	F O N	F O N	F O N

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	TASKS/ACTIVITIES	TYPE OF EXPOSURE						
		Air Quality	Physical	Hazardous Materials	Flammable Materials	Material Handling	Mechanical & Electrical	Facilities
340.	Personal protective clothing.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
341.	Modification of building structure.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
342.	Isolation of source.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
343.	Rotation of personnel.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
344.	Special labeling or posting of warnings.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
345.	Storage control.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
346.	General ventilation.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
347.	Local exhaust ventilation.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
348.	Worker exposure monitoring.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
349.	Health/safety training for workers.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
350.	Housekeeping modifications.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
351.	Modification to maintenance procedures and schedules.	F O N	F O N	F O N	F O N	F O N	F O N	F O N

TASK/ACTIVITY by Type Exposure Checklist. SIC__________ ID__________

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		TYPE OF EXPOSURE						
	TASKS/ACTIVITIES	Air Quality	Physical	Hazardous Materials	Flammable Materials	Material Handling	Mechanical & Electrical	Facilities
352.	Monitoring of workers physical condition by medical personnel.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
353.	Installation of continuous monitoring and warning equipment.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
354.	Tagging and removing from operation.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
355.	Limiting worker exposure time.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
356.	Lockout procedures.	F O N	F O N	F O N	F O N	F O N	F O N	F O N
357.	Other controls. Specify ______________________________ ______________________________	F O N	F O N	F O N	F O N	F O N	F O N	F O N
Enter any additional task/activities you might perform below. 358.		F O N	F O N	F O N	F O N	F O N	F O N	F O N
359.		F O N	F O N	F O N	F O N	F O N	F O N	F O N
360.		F O N	F O N	F O N	F O N	F O N	F O N	F O N
361.		F O N	F O N	F O N	F O N	F O N	F O N	F O N
362.		F O N	F O N	F O N	F O N	F O N	F O N	F O N
		F O N	F O N	F O N	F O N	F O N	F O N	F O N

TASK/ACTIVITY by Type Exposure Checklist. SIC________ ID________

APPENDIX III

Summaries of Incumbent Background Data

SUMMARY OF INCUMBENT BACKGROUND DATA
(IH Technician and SP Technician)

	Industrial Hygiene Technician	Safety Professional Technician
Number in Sample	20	65
Age		
Range	24-56	22-60
Mean	40.3	40.3
Standard Deviation	9.4	10.4
Responsibility		
Industrial Hygiene Director/Manager	2	0
Safety Director/Manager	0	22
Loss Prevention and Control Manager	0	3
Industrial Hygienist	0	0
Safety Engineer	0	11
Industrial Hygiene Technician	15	0
Safety Technician	1	13
Safety Inspector	0	8
Compliance Officer	0	1
Other	2	7
Responsibility Level		
Industrial Hygiene		
Total Organization	1	0
Region or Group Locations	2	0
Single Site	9	0
Consulting	0	0
Safety		
Total Organization	0	4
Region or Group Locations	0	7
Single Site	1	6
Consulting	0	3
Both Industrial Hygiene and Safety		
Total Organization	0	10
Region or Group Locations	3	11
Single Site	3	21
Consulting	0	2
Years in Current Position		
Range	1-23	1-30
Mean	5.4	4.3
Standard Deviation	6.7	6.0
Years With Current Employer		
Range	1-25	1-34
Mean	10.2	11.1
Standard Deviation	8.9	9.6

SUMMARY OF INCUMBENT BACKGROUND DATA
(IH Technician and SP Technician) - continued

	Industrial Hygiene Technician	Safety Professional Technician
Total Years Full-Time Work Experience		
Range	1-31	1-40
Mean	17.9	16.1
Standard Deviation	10.6	11.7
Highest Academic Level		
Doctorate	0	0
Masters	0	0
Graduate Study, No Degree	1	1
Bachelors Degree	1	4
Associate Degree	3	14
Less than Associate	15	46
Degrees Held		
Associate		
Engineering	1	6
Basic Science	2	5
Bachelors		
Engineering	0	0
Basic Science	1	2
Liberal Arts	1	0
Education	0	0
Medicine	0	0
Masters		
Industrial Hygiene	0	0
Engineering	0	0
Basic Science	0	1
Medicine	0	0
Doctorate		
Industrial Hygiene	0	0
Safety Engineering	0	0
Engineering	0	0
Medicine	0	0
Other	0	0
Year Last Degree Earned		
Range	1950-1976	1962-1976
Mean	1968	1971
Standard Deviation	10.6	4.7
Certifications Held		
ABIH	0/20	0/65
BCSP	0/20	0/65
Professional Engineer	0/20	0/65

III-4

SUMMARY OF INCUMBENT BACKGROUND DATA (IH Technician and SP Technician) - continued

	Industrial Hygiene Technician	Safety Professional Technician
Number and Percent of Incumbent Practitioners Spending 10% or More Time in:		
Industrial Hygiene		
Number	18	23
Percent	90	35
Safety		
Number	6	64
Percent	30	98
Plant or Organizational Personnel		
Number	2	13
Percent	10	20
Engineering		
Number	3	10
Percent	15	5
Other		
Number	7	15
Percent	35	23

SUMMARY OF INCUMBENT BACKGROUND DATA
(IH In Training and SP In Training)

	Industrial Hygiene In Training	Safety Professional In Training
Number in Sample	149	314
Age		
Range	21-58	22-65
Mean	36.1	41.6
Standard Deviation	9.8	11.0
Responsibility		
Industrial Hygiene Director/Manager	21	1
Safety Director/Manager	2	95
Loss Prevention and Control Manager	3	30
Industrial Hygienist	92	1
Safety Engineer	1	130
Industrial Hygiene Technician	5	0
Safety Technician	0	11
Safety Inspector	0	5
Compliance Officer	0	0
Other	25	41
Responsibility Level		
Industrial Hygiene		
Total Organization	46	0
Region or Group Locations	41	0
Single Site	26	0
Consulting	13	0
Safety		
Total Organization	3	37
Region or Group Locations	0	36
Single Site	0	27
Consulting	0	10
Both Industrial Hygiene and Safety		
Total Organization	5	50
Region or Group Locations	9	52
Single Site	4	77
Consulting	2	24
Years in Current Position		
Range	1-23	1-52
Mean	3.8	6.2
Standard Deviation	3.6	6.4
Years With Current Employer		
Range	1-32	1-41
Mean	7.2	12.3
Standard Deviation	7.5	10.3

SUMMARY OF INCUMBENT BACKGROUND DATA
(IH In Training and SP In Training) - continued

	Industrial Hygiene In Training	Safety Professional In Training
Total Years Full-Time Work Experience		
Range	1-39	1-50
Mean	11.3	18.2
Standard Deviation	9.2	11.7
Highest Academic Level		
Doctorate	16	3
Masters	63	37
Graduate Study, No Degree	32	43
Bachelors Degree	38	120
Associate Degree	0	17
Less than Associate	0	94
Degrees Held		
Associate		
Engineering	2	72
Basic Science	4	7
Bachelors		
Engineering	50	78
Basic Science	79	33
Liberal Arts	3	23
Education	1	15
Medicine	3	0
Masters		
Industrial Hygiene	47	1
Engineering	10	15
Basic Science	10	1
Medicine	0	0
Doctorate		
Industrial Hygiene	4	0
Safety Engineering	0	0
Engineering	3	0
Medicine	0	0
Other	1	0
Year Last Degree Earned		
Range	1941-1976	1933-1976
Mean	1966	1964
Standard Deviation	8.8	10.3
Certifications Held		
ABIH	2/149	0/314
BCSP	12/149	3/314
Professional Engineer	11/149	26/314

SUMMARY OF INCUMBENT BACKGROUND DATA
(IH In Training and SP In Training) - continued

	Industrial Hygiene In Training	Safety Professional In Training
Number and Percent of Incumbent Practitioners Spending 10% or More Time in:		
Industrial Hygiene		
Number	139	147
Percent	93	47
Safety		
Number	25	305
Percent	18	97
Plant or Organizational Personnel		
Number	9	93
Percent	6	30
Engineering		
Number	18	91
Percent	12	29
Other		
Number	28	81
Percent	19	26

SUMMARY OF INCUMBENT BACKGROUND DATA
(IH Professional and SP Professional)

	Industrial Hygiene Professional	Safety Professional Professional
Number in Sample	56	127
Age		
Range	29-70	23-67
Mean	46.8	48.2
Standard Deviation	12.5	9.4
Responsibility		
Industrial Hygiene Director/Manager	9	0
Safety Director/Manager	0	32
Loss Prevention and Control Manager	0	22
Industrial Hygienist	37	3
Safety Engineer	0	51
Industrial Hygiene Technician	0	0
Safety Technician	0	0
Safety Inspector	0	0
Compliance Officer	0	0
Other	10	19
Responsibility Level		
Industrial Hygiene		
Total Organization	15	0
Region or Group Locations	11	0
Single Site	3	1
Consulting	12	0
Safety		
Total Organization	0	19
Region or Group Locations	0	8
Single Site	0	5
Consulting	0	14
Both Industrial Hygiene and Safety		
Total Organization	7	31
Region or Group Locations	1	17
Single Site	1	14
Consulting	6	18
Years in Current Position		
Range	1-39	1-26
Mean	7.5	8.0
Standard Deviation	8.0	6.8
Years With Current Employer		
Range	1-32	1-41
Mean	9.8	12.4
Standard Deviation	9.0	10.2

SUMMARY OF INCUMBENT BACKGROUND DATA
(IH Professional and SP Professional) - continued

	Industrial Hygiene Professional	Safety Professional Professional
Total Years Full-Time Work Experience		
Range	4-50	4-41
Mean	22.1	21.9
Standard Deviation	12.0	9.1
Highest Academic Level		
Doctorate	4	3
Masters	22	17
Graduate Study, No Degree	9	31
Bachelors Degree	21	50
Associate Degree	0	5
Less than Associate	0	21
Degrees Held		
Associate		
Engineering	1	8
Basic Science	0	3
Bachelors		
Engineering	23	53
Basic Science	25	13
Liberal Arts	0	11
Education	0	3
Medicine	1	0
Masters		
Industrial Hygiene	12	2
Engineering	3	10
Basic Science	7	3
Medicine	1	0
Doctorate		
Industrial Hygiene	2	0
Safety Engineering	0	0
Engineering	0	0
Medicine	0	0
Other	0	2
Year Last Degree Earned		
Range	1927-1975	1934-1976
Mean	1954	1956
Standard Deviation	13.8	10.4
Certifications Held		
ABIH	56/56	5/127
BCSP	24/56	127/127
Professional Engineer	13/56	32/127

SUMMARY OF INCUMBENT BACKGROUND DATA (IH Professional and SP Professional) - continued

	Industrial Hygiene Professional	Safety Professional Professional
Number and Percent of Incumbent Practitioners Spending 10% or More Time in:		
Industrial Hygiene		
Number	53	67
Percent	95	58
Safety		
Number	14	119
Percent	25	94
Plant or Organizational Personnel		
Number	2	23
Percent	3	18
Engineering		
Number	6	36
Percent	10	28
Other		
Number	11	32
Percent	20	25

SUMMARY OF INCUMBENT BACKGROUND DATA
(IH Administrator and SP Administrator)

	Industrial Hygiene Administrator	Safety Professional Administrator
Number in Sample	39	78
Age		
Range	27-63	28-66
Mean	45.9	50.1
Standard Deviation	9.2	8.2
Responsibility		
Industrial Hygiene Director/Manager	31	1
Safety Director/Manager	1	43
Loss Prevention and Control Manager	2	26
Industrial Hygienist	3	0
Safety Engineer	0	5
Industrial Hygiene Technician	0	0
Safety Technician	0	0
Safety Inspector	0	0
Compliance Officer	0	0
Other	2	3
Responsibility Level		
Industrial Hygiene		
Total Organization	24	0
Region or Group Locations	3	0
Single Site	4	0
Consulting	1	0
Safety		
Total Organization	0	18
Region or Group of Locations	0	3
Single Site	0	4
Consulting	0	3
Both Industrial Hygiene and Safety		
Total Organization	6	32
Region or Group of Locations	0	13
Single Site	0	1
Consulting	1	4
Years in Current Position		
Range	1-32	1-39
Mean	7.0	10.1
Standard Deviation	7.0	8.3
Years With Current Employer		
Range	1-32	1-40
Mean	12.3	16.8
Standard Deviation	8.6	10.2

SUMMARY OF INCUMBENT BACKGROUND DATA
(IH Administrator and SP Administrator) - continued

	Industrial Hygiene Administrator	Safety Professional Administrator
Total Years Full-Time Work Experience		
Range	5-42	4-49
Mean	20.7	25.8
Standard Deviation	9.3	9.2
Highest Academic Level		
Doctorate	7	1
Masters	20	15
Graduate Study, No Degree	5	12
Bachelors Degree	7	34
Associate Degree	0	1
Less than Associate	0	15
Degrees Held		
Associate		
Engineering	1	3
Basic Science	1	4
Bachelors		
Engineering	18	26
Basic Science	15	12
Liberal Arts	1	1
Education	0	4
Medicine	1	0
Masters		
Industrial Hygiene	14	7
Engineering	2	8
Basic Science	5	1
Medicine	0	0
Doctorate		
Industrial Hygiene	7	0
Safety Engineering	0	1
Engineering	0	0
Medicine	0	0
Other	1	0
Year Last Degree Earned		
Range	1934-1974	1934-1975
Mean	1957	1954
Standard Deviation	10.5	8.9
Certifications Held		
ABIH	39/39	7/78
BCSP	16/39	78/78
Professional Engineer	8/39	25/78

SUMMARY OF INCUMBENT BACKGROUND DATA (IH Administrator and SP Administrator) - continued

	Industrial Hygiene Administrator	Safety Professional Administrator
Number and Percent of Incumbent Practitioners Spending 10% or More Time in:		
Industrial Hygiene		
Number	39	41
Percent	100	53
Safety		
Number	12	74
Percent	31	95
Plant or Organizational Personnel		
Number	5	22
Percent	13	28
Engineering		
Number	6	22
Percent	15	28
Other		
Number	13	22
Percent	33	17

APPENDIX IV

A Summary of the Incumbent Personnel Responses for Each Task/Activity: Percentage of Sampled Incumbent Personnel Indicating the Task/Activity is Performed and the Criterion Level of Performance

Code of Symbols
for
APPENDIX I

Level of Assignment:

1 - Technician

2 - In-Training

3 - Professional

4 - Administrator

Criterion Level of Performance:

1/3 - indicates that the sample percentage is significantly greater ($\alpha = .05$) than 33%

1/2 - indicates that the sample percentage is significantly greater ($\alpha = .05$) than 50%

2/3 - indicates that the sample percentage is significantly greater ($\alpha = .05$) than 67%

N - indicates that the task/activity is not performed (i.e., the sample percentage does not meet the minimum criterion of 1/3)

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
1	55 1/3	50 1/3	27 N	40 N	71 1/2	70 1/2	50 1/3	55 1/3
2	30 N	56 1/3	65 1/2	97 2/3	53 1/3	61 1/2	64 1/2	96 2/3
3	30 N	51 1/3	57 1/3	94 2/3	45 1/3	59 1/2	61 1/2	99 2/3
4	45 N	88 2/3	87 2/3	89 2/3	69 1/2	82 2/3	73 1/2	80 2/3
5	20 N	70 1/2	52 1/3	77 1/2	50 1/3	71 2/3	73 1/2	71 1/2
6	40 N	79 2/3	78 2/3	97 2/3	66 1/2	80 2/3	83 2/3	87 2/3
7	45 N	81 2/3	73 1/2	95 2/3	71 1/2	83 2/3	87 2/3	83 2/3
8	25 N	73 2/3	78 2/3	98 2/3	37 N	67 1/2	77 2/3	72 1/2
9	0 N	6 N	6 N	8 N	29 N	38 1/3	33 N	51 1/3
10	10 N	40 1/3	32 N	49 1/3	40 N	55 1/2	63 1/2	81 2/3
11	50 N	94 2/3	84 2/3	100 2/3	92 2/3	98 2/3	95 2/3	99 2/3
12	40 N	72 1/2	77 2/3	100 2/3	83 2/3	86 2/3	89 2/3	96 2/3
13	15 N	48 1/3	61 1/2	95 2/3	67 1/2	73 2/3	68 1/2	86 2/3
14	15 N	32 N	21 N	66 1/2	63 1/2	73 2/3	65 1/2	71 1/2
15	20 N	31 N	23 N	56 1/3	69 1/2	72 2/3	56 1/3	68 1/2
16	30 N	47 1/3	41 N	62 1/3	78 2/3	80 2/3	74 2/3	74 1/2
17	25 N	86 2/3	97 2/3	95 2/3	88 2/3	94 2/3	96 2/3	99 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
18	30 N	77 2/3	68 1/2	94 2/3	78 2/3	84 2/3	90 2/3	92 2/3
19	25 N	80 2/3	84 2/3	90 2/3	91 2/3	89 2/3	91 2/3	90 2/3
20	15 N	16 N	9 N	8 N	49 1/3	46 1/3	46 1/3	53 1/3
21	20 N	53 1/3	50 1/3	62 1/3	71 1/2	75 2/3	71 1/2	80 2/3
22	0 N	2 N	2 N	8 N	38 N	38 1/3	36 N	34 N
23	0 N	10 N	16 N	18 N	40 N	42 1/3	34 N	43 1/3
24	0 N	1 N	0 N	3 N	22 N	20 N	20 N	20 N
25	20 N	56 1/3	55 1/3	66 1/2	38 N	47 1/3	44 1/3	52 1/3
26	5 N	43 1/3	50 1/3	87 2/3	43 1/3	49 1/3	51 1/3	88 2/3
27	20 N	25 N	11 N	26 N	44 1/3	55 1/2	50 1/3	63 1/2
28	10 N	5 N	6 N	3 N	55 1/3	46 1/3	33 N	25 N
29	5 N	29 N	32 N	49 1/3	20 N	27 N	33 N	39 N
30	25 N	45 1/3	36 N	54 1/3	54 1/3	65 1/2	65 1/2	84 2/3
31	45 N	74 2/3	59 1/3	77 1/2	31 N	52 1/3	53 1/3	60 1/2
32	0 N	21 N	26 N	43 N	46 1/3	48 1/3	46 1/3	51 1/3
33	45 N	89 2/3	75 1/2	82 2/3	92 2/3	96 2/3	92 2/3	87 2/3
34	55 1/3	83 2/3	67 1/2	72 1/2	93 2/3	90 2/3	82 2/3	75 1/2

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL O F ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
35	60 1/3	88 2/3	81 2/3	98 2/3	88 2/3	91 2/3	93 2/3	98 2/3
36	15 N	72 1/2	81 2/3	89 2/3	66 1/2	83 2/3	91 2/3	94 2/3
37	5 N	5 N	4 N	11 N	29 N	40 1/3	48 1/3	67 1/2
38	10 N	38 N	45 1/3	64 1/2	28 N	37 N	42 1/3	49 1/3
39	15 N	46 1/3	47 1/3	71 1/2	17 N	38 1/3	48 1/3	45 1/3
40	0 N	26 N	30 N	51 1/3	40 N	37 N	36 N	48 1/3
41	20 N	42 1/3	36 N	66 1/2	30 N	28 N	24 N	34 N
42	25 N	40 1/3	40 N	61 1/3	25 N	18 N	15 N	20 N
43	20 N	50 1/3	46 1/3	77 1/2	33 N	39 1/3	39 N	59 1/2
44	10 N	13 N	5 N	10 N	77 2/3	86 2/3	86 2/3	86 2/3
45	20 N	42 1/3	37 N	51 1/3	34 N	49 N	33 N	46 1/3
46	30 N	66 1/2	59 1/3	93 2/3	43 1/3	55 1/2	48 1/3	50 1/3
47	60 1/3	64 1/2	41 N	59 1/3	51 1/3	49 1/3	36 N	38 N
48	15 N	18 N	6 N	16 N	79 2/3	74 2/3	59 1/2	61 1/2
49	15 N	25 N	25 N	30 N	22 N	30 N	22 N	19 N
50	10 N	40 1/3	32 N	61 1/3	55 1/3	51 1/3	45 1/3	53 1/3
51	60 1/3	89 2/3	86 2/3	95 2/3	93 2/3	92 2/3	89 2/3	91 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
52	75 1/2	89 2/3	88 2/3	82 2/3	48 1/3	60 1/2	57 1/2	40 N
53	85 2/3	90 2/3	91 2/3	74 1/2	32 N	42 1/3	37 N	32 N
54	90 2/3	93 2/3	92 2/3	90 2/3	48 1/3	62 1/2	55 1/3	42 1/3
55	90 2/3	92 2/3	91 2/3	84 2/3	63 1/2	68 1/2	64 1/2	46 1/3
56	80 1/2	90 2/3	89 2/3	87 2/3	53 1/3	62 1/2	57 1/2	44 1/3
57	70 1/2	72 1/2	71 1/2	64 1/2	29 N	39 1/3	37 N	30 N
58	45 N	39 N	43 N	54 1/3	20 N	18 N	20 N	10 N
59	40 N	40 1/3	40 N	53 1/3	15 N	13 N	14 N	9 N
60	N	N	N	N	N	N	N	N
61	60 1/3	86 2/3	89 2/3	80 2/3	42 N	56 1/2	48 1/3	49 1/3
62	65 1/3	83 2/3	79 2/3	82 2/3	23 N	36 N	36 N	32 N
63	25 N	51 1/3	61 1/2	66 1/2	21 N	25 N	31 N	32 N
64	N	N	N	N	N	N	N	N
65	75 1/2	84 2/3	82 2/3	77 1/2	21 N	40 1/3	34 N	29 N
66	55 1/3	80 2/3	80 2/3	72 1/2	17 N	25 N	28 N	17 N
67	15 N	55 1/3	50 1/3	54 1/3	21 N	18 N	21 N	18 N
68	25 N	42 1/3	50 1/3	46 1/3	20 N	18 N	24 N	17 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
69	5 N	22 N	21 N	13 N	8 N	3 N	6 N	4 N
70	35 N	58 1/2	48 1/3	59 1/3	11 N	9 N	13 N	16 N
71	35 N	47 1/3	39 N	28 N	9 N	11 N	17 N	13 N
72	45 N	62 1/2	60 1/3	54 1/3	10 N	15 N	19 N	14 N
73	60 1/3	66 1/2	80 2/3	67 1/2	11 N	25 N	21 N	22 N
74	30 N	56 1/3	54 1/3	56 1/3	6 N	12 N	10 N	18 N
75	70 1/2	74 2/3	82 2/3	59 1/3	11 N	24 N	28 N	18 N
76	65 1/3	74 2/3	84 2/3	69 1/2	23 N	28 N	28 N	20 N
77	50 N	77 2/3	83 2/3	72 1/2	12 N	14 N	22 N	19 N
78	45 N	53 1/3	66 1/2	59 1/3	7 N	11 N	8 N	8 N
79	5 N	35 N	37 N	33 N	4 N	6 N	10 N	7 N
80	N	N	N	N	N	N	N	N
81	50 N	68 1/2	78 2/3	66 1/2	21 N	31 N	30 N	33 N
82	25 N	33 N	26 N	44 N	2 N	6 N	12 N	11 N
83	30 N	50 1/3	52 1/3	57 1/3	10 N	15 N	18 N	22 N
84	5 N	10 N	8 N	21 N	0 N	1 N	5 N	5 N
85	60 1/3	75 2/3	66 1/2	70 1/2	6 N	13 N	17 N	14 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
86	75 1/2	84 2/3	87 2/3	72 1/2	14 N	29 N	33 N	31 N
87	70 1/2	88 2/3	90 2/3	85 2/3	35 N	46 1/3	45 1/3	33 N
88	75 1/2	78 2/3	79 2/3	66 1/2	46 1/3	54 1/3	53 1/3	48 1/3
89	30 N	21 N	29 N	28 N	2 N	3 N	3 N	2 N
90	75 1/2	91 2/3	91 2/3	84 2/3	14 N	24 N	27 N	23 N
91	85 2/3	89 2/3	91 2/3	79 2/3	45 1/3	52 1/3	47 1/3	35 N
92	15 N	12 N	10 N	11 N	2 N	2 N	2 N	4 N
93	5 N	8 N	7 N	8 N	5 N	3 N	2 N	1 N
94	25 N	22 N	34 N	28 N	8 N	7 N	8 N	7 N
95	65 1/3	84 2/3	88 2/3	69 1/2	31 N	40 1/3	40 1/3	36 N
96	N	N	N	N	N	N	N	N
97	25 N	47 1/3	50 1/3	33 N	11 N	9 N	12 N	13 N
98	10 N	22 N	12 N	20 N	0 N	1 N	3 N	6 N
99	20 N	22 N	25 N	36 N	3 N	8 N	10 N	10 N
100	4 N	5 N	4 N	13 N	0 N	0 N	3 N	1 N
101	20 N	34 N	30 N	31 N	2 N	3 N	8 N	4 N
102	50 N	54 1/3	68 1/2	33 N	3 N	10 N	12 N	10 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
103	75 1/2	74 2/3	82 2/3	54 1/3	15 N	24 N	25 N	25 N
104	20 N	29 N	23 N	18 N	2 N	4 N	4 N	3 N
105	40 N	50 1/3	57 1/3	38 N	26 N	35 N	28 N	34 N
106	10 N	7 N	13 N	8 N	0 N	1 N	1 N	1 N
107	60 1/3	78 2/3	80 2/3	54 1/3	12 N	18 N	16 N	17 N
108	60 1/3	74 2/3	80 2/3	54 1/3	22 N	19 N	19 N	17 N
109	0 N	3 N	2 N	5 N	0 N	0 N	0 N	0 N
110	N	N	N	N	N	N	N	N
111	10 N	53 1/3	57 1/3	62 1/3	4 N	11 N	18 N	18 N
112	15 N	47 1/3	56 1/3	53 1/3	14 N	19 N	24 N	16 N
113	5 N	46 1/3	62 1/2	59 1/3	17 N	18 N	26 N	22 N
114	10 N	41 1/3	48 1/3	44 N	33 N	36 N	32 N	26 N
115	20 N	49 1/3	55 1/3	59 1/3	20 N	24 N	30 N	21 N
116	25 N	58 1/2	63 1/2	67 1/2	17 N	24 N	21 N	26 N
117	15 N	71 1/2	75 1/2	72 1/2	36 N	42 1/3	48 1/3	43 1/3
118	25 N	52 1/3	60 1/2	74 1/2	8 N	10 N	11 N	16 N
119	80 1/2	89 2/3	85 2/3	84 2/3	28 N	43 1/3	49 1/3	48 1/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
120	60 1/3	68 1/2	73 1/2	75 1/2	21 N	26 N	23 N	30 N
121	25 N	21 N	18 N	15 N	3 N	2 N	3 N	5 N
122	50 N	73 2/3	75 1/2	61 1/3	3 N	5 N	14 N	8 N
123	35 N	50 1/3	59 1/3	54 1/3	3 N	7 N	7 N	7 N
124	30 N	26 N	33 N	35 N	15 N	5 N	3 N	6 N
125	20 N	8 N	12 N	8 N	2 N	3 N	5 N	5 N
126	65 1/3	68 1/2	75 1/2	69 1/2	2 N	4 N	9 N	9 N
127	N	N	N	N	N	N	N	N
128	30 N	56 1/3	54 1/3	46 1/3	5 N	9 N	13 N	13 N
129	30 N	43 1/3	32 N	33 N	5 N	6 N	6 N	5 N
130	10 N	10 N	11 N	6 N	8 N	10 N	11 N	9 N
131	5 N	3 N	7 N	3 N	7 N	3 N	9 N	9 N
132	5 N	2 N	2 N	3 N	3 N	3 N	8 N	0 N
133	20 N	10 N	11 N	3 N	7 N	9 N	9 N	11 N
134	70 1/2	88 2/3	85 2/3	84 2/3	65 1/2	78 2/3	82 2/3	66 1/2
135	55 1/3	81 2/3	79 2/3	77 1/2	20 N	33 N	43 1/3	43 1/3
136	45 N	52 1/3	56 1/3	49 1/3	8 N	20 N	18 N	22 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
137	20 N	19 N	10 N	18 N	5 N	5 N	4 N	6 N
138	20 N	19 N	12 N	20 N	13 N	13 N	10 N	20 N
139	50 N	75 2/3	78 2/3	71 1/2	15 N	27 N	29 N	34 N
140	70 1/2	73 2/3	73 1/2	76 1/2	47 1/3	45 1/3	51 1/3	42 1/3
141	15 N	20 N	13 N	13 N	5 N	10 N	10 N	8 N
142	N	N	N	N	N	N	N	N
143	55 1/3	84 2/3	79 2/3	72 1/2	52 1/3	60 1/2	55 1/3	46 1/3
144	45 N	69 1/2	66 1/2	62 1/3	16 N	18 N	14 N	23 N
145	30 N	30 N	23 N	18 N	3 N	6 N	5 N	12 N
146	15 N	11 N	4 N	11 N	2 N	2 N	0 N	4 N
147	10 N	9 N	4 N	13 N	8 N	4 N	3 N	13 N
148	25 N	22 N	16 N	30 N	2 N	5 N	6 N	15 N
149	55 1/3	65 1/2	59 1/3	57 1/3	33 N	25 N	22 N	24 N
150	15 N	12 N	6 N	10 N	3 N	7 N	4 N	6 N
151	5 N	15 N	21 N	15 N	8 N	9 N	8 N	9 N
152	N	N	N	N	N	N	N	N
153	5 N	36 N	48 1/3	28 N	11 N	19 N	30 N	14 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
154	50 N	83 2/3	82 2/3	75 1/2	59 1/3	64 1/2	68 1/2	58 1/3
155	30 N	59 1/2	71 1/2	64 1/2	34 N	43 1/3	53 1/3	39 N
156	0 N	25 N	27 N	25 N	5 N	12 N	15 N	12 N
157	5 N	20 N	17 N	36 N	6 N	9 N	8 N	9 N
158	5 N	46 1/3	47 1/3	28 N	11 N	16 N	15 N	16 N
159	10 N	54 1/3	57 1/3	77 1/2	36 N	50 1/3	52 1/3	58 1/3
160	15 N	21 N	30 N	23 N	7 N	5 N	8 N	6 N
161	10 N	10 N	9 N	23 N	6 N	5 N	7 N	5 N
162	40 N	38 N	48 1/3	44 N	9 N	15 N	15 N	15 N
163	5 N	14 N	16 N	18 N	2 N	3 N	3 N	2 N
164	20 N	20 N	25 N	28 N	7 N	5 N	8 N	6 N
165	20 N	14 N	20 N	23 N	2 N	4 N	5 N	3 N
166	10 N	14 N	24 N	18 N	3 N	2 N	4 N	1 N
167	15 N	3 N	4 N	5 N	2 N	4 N	2 N	1 N
168	35 N	36 N	30 N	31 N	7 N	9 N	15 N	11 N
169	10 N	5 N	2 N	3 N	3 N	2 N	0 N	1 N
170	10 N	11 N	16 N	18 N	4 N	4 N	2 N	6 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
171	5 N	12 N	18 N	18 N	5 N	5 N	7 N	7 N
172	N	N	N	N	N	N	N	N
173	55 1/3	35 N	50 1/3	41 N	11 N	17 N	14 N	18 N
174	40 N	28 N	35 N	38 N	7 N	19 N	18 N	17 N
175	30 N	22 N	31 N	33 N	11 N	16 N	12 N	15 N
176	5 N	8 N	4 N	3 N	5 N	2 N	3 N	5 N
177	35 N	27 N	32 N	30 N	5 N	5 N	7 N	13 N
178	20 N	8 N	7 N	8 N	4 N	3 N	4 N	5 N
179	30 N	12 N	7 N	18 N	4 N	5 N	5 N	6 N
180	N	N	N	N	N	N	N	N
181	25 N	18 N	25 N	28 N	4 N	8 N	12 N	16 N
182	25 N	21 N	23 N	31 N	4 N	10 N	13 N	16 N
183	25 N	22 N	18 N	31 N	8 N	11 N	15 N	19 N
184	35 N	30 N	34 N	38 N	8 N	16 N	20 N	29 N
185	25 N	20 N	23 N	20 N	8 N	10 N	13 N	24 N
186	35 N	27 N	29 N	18 N	11 N	12 N	12 N	18 N
187	30 N	22 N	22 N	23 N	9 N	13 N	16 N	25 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
188	5 N	15 N	18 N	13 N	4 N	6 N	7 N	15 N
189	30 N	21 N	22 N	23 N	9 N	9 N	10 N	20 N
190	N	N	N	N	N	N	N	N
191	10 N	22 N	23 N	38 N	10 N	15 N	22 N	27 N
192	20 N	13 N	20 N	16 N	17 N	18 N	26 N	38 N
193	20 N	9 N	14 N	13 N	15 N	11 N	11 N	21 N
194	20 N	12 N	16 N	16 N	13 N	17 N	21 N	38 N
195	20 N	13 N	18 N	18 N	18 N	20 N	24 N	44 1/3
196	40 N	52 1/3	53 1/3	69 1/2	33 N	34 N	40 1/3	37 N
197	45 N	35 N	25 N	44 N	19 N	21 N	21 N	18 N
198	45 N	39 N	39 N	59 1/3	23 N	25 N	30 N	40 N
199	30 N	49 1/3	43 N	69 1/2	33 N	33 N	39 N	39 N
200	50 N	76 2/3	80 2/3	93 2/3	40 N	48 1/3	56 1/3	54 1/3
201	50 N	76 2/3	70 1/2	77 1/2	20 N	30 N	31 N	28 N
202	50 N	73 2/3	68 1/2	77 1/2	18 N	26 N	31 N	27 N
203	50 N	66 1/2	68 1/2	77 1/2	11 N	16 N	26 N	20 N
204	40 N	31 N	41 N	36 N	10 N	7 N	11 N	17 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
205	50 N	73 2/3	73 1/2	77 1/2	14 N	28 N	28 N	35 N
206	N	N	N	N	N	N	N	N
207	55 1/3	86 2/3	96 2/3	87 2/3	91 2/3	95 2/3	96 2/3	94 2/3
208	20 N	59 1/2	55 1/3	70 1/2	61 1/2	74 2/3	73 1/2	82 2/3
209	15 N	12 N	7 N	16 N	66 1/2	79 2/3	73 1/2	84 2/3
210	10 N	8 N	5 N	8 N	65 1/2	69 1/2	56 1/3	58 1/3
211	15 N	4 N	4 N	10 N	30 N	34 N	35 N	58 1/3
212	10 N	5 N	0 N	5 N	49 1/3	57 1/2	64 1/2	50 1/3
213	5 N	3 N	2 N	3 N	46 1/3	44 1/3	39 N	48 1/3
214	5 N	3 N	0 N	0 N	40 N	39 1/3	32 N	26 N
215	10 N	6 N	4 N	13 N	60 1/2	62 1/2	59 1/2	59 1/2
216	25 N	8 N	5 N	5 N	68 1/2	76 2/3	63 1/2	69 1/2
217	15 N	13 N	9 N	5 N	75 1/2	69 1/2	55 1/3	45 1/3
218	15 N	13 N	7 N	10 N	69 1/2	61 1/2	47 1/3	46 1/3
219	0 N	4 N	2 N	5 N	21 N	22 N	21 N	13 N
220	10 N	15 N	9 N	13 N	54 1/3	63 1/2	47 1/3	50 1/3
221	N	N	N	N	N	N	N	N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
222	10 N	17 N	23 N	21 N	51 1/3	64 1/2	64 1/2	56 1/3
223	15 N	24 N	27 N	28 N	80 2/3	82 2/3	75 2/3	71 1/2
224	5 N	8 N	5 N	18 N	43 1/3	61 1/2	68 1/2	65 1/2
225	20 N	15 N	13 N	18 N	83 2/3	85 2/3	83 2/3	72 1/2
226	5 N	12 N	9 N	13 N	35 N	42 1/3	36 N	37 N
227	5 N	19 N	16 N	20 N	61 1/2	67 1/2	72 1/2	72 1/2
228	0 N	12 N	5 N	13 N	5 N	12 N	17 N	18 N
229	0 N	11 N	7 N	13 N	11 N	10 N	8 N	15 N
230	0 N	10 N	7 N	20 N	15 N	15 N	13 N	18 N
231	0 N	14 N	7 N	18 N	32 N	38 1/3	29 N	28 N
232	N	N	N	N	N	N	N	N
233	15 N	42 1/3	43 N	56 1/3	40 N	67 1/2	81 2/3	68 1/2
234	25 N	23 N	16 N	23 N	29 N	40 1/3	52 1/3	47 1/3
235	20 N	37 N	34 N	49 1/3	42 N	59 1/2	71 1/2	72 1/2
236	15 N	41 1/3	36 N	59 1/3	40 N	68 1/2	82 2/3	76 2/3
237	20 N	9 N	6 N	7 N	60 1/2	57 1/2	56 1/3	60 1/2
238	20 N	10 N	7 N	13 N	52 1/3	52 1/3	48 1/3	40 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
239	0 N	4 N	2 N	3 N	35 N	37 N	39 N	39 N
240	0 N	12 N	11 N	5 N	57 1/3	57 1/2	59 1/2	51 1/3
241	40 N	53 1/3	47 1/3	64 1/2	94 2/3	95 2/3	94 2/3	94 2/3
242	20 N	16 N	19 N	16 N	34 N	44 1/3	47 1/3	45 1/3
243	5 N	6 N	11 N	8 N	18 N	14 N	16 N	15 N
244	5 N	1 N	4 N	3 N	17 N	11 N	15 N	13 N
245	5 N	14 N	16 N	13 N	38 N	41 1/3	44 1/3	46 1/3
246	15 N	14 N	15 N	15 N	37 N	41 1/3	43 1/3	42 1/3
247	10 N	8 N	12 N	13 N	41 N	52 1/3	48 1/3	54 1/3
248	5 N	4 N	9 N	5 N	19 N	24 N	28 N	27 N
249	0 N	1 N	4 N	0 N	14 N	10 N	13 N	12 N
250	N	N	N	N	N	N	N	N
251	5 N	20 N	15 N	15 N	66 1/2	67 1/2	68 1/2	63 1/2
252	20 N	38 N	34 N	36 N	66 1/2	70 1/2	68 1/2	68 1/2
253	60 1/3	69 1/2	68 1/2	67 1/2	86 2/3	93 2/3	86 2/3	75 1/2
254	0 N	13 N	2 N	11 N	48 1/3	55 1/2	56 1/3	58 1/3
255	10 N	32 N	41 N	54 1/3	27 N	45 1/3	60 1/2	59 1/2

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
256	20 N	64 1/2	62 1/2	75 1/2	70 1/2	81 2/3	82 2/3	75 1/2
257	25 N	63 1/2	63 1/2	87 2/3	77 2/3	82 2/3	85 2/3	86 2/3
258	20 N	29 N	34 N	38 N	43 1/3	50 1/3	52 1/3	50 1/3
259	25 N	59 1/2	60 1/2	69 1/2	61 1/2	76 2/3	74 2/3	74 1/2
260	25 N	49 1/3	60 1/2	69 1/2	51 1/3	55 1/2	53 1/3	48 1/3
261	0 N	11 N	4 N	10 N	20 N	33 N	38 N	33 N
262	5 N	4 N	2 N	8 N	12 N	24 N	22 N	18 N
263	5 N	6 N	4 N	8 N	52 1/3	46 1/3	46 1/3	38 N
264	5 N	11 N	11 N	10 N	74 1/2	79 2/3	78 2/3	84 2/3
265	20 N	45 1/3	50 1/3	51 1/3	34 N	36 N	36 N	40 N
266	30 N	44 1/3	52 1/3	59 1/3	36 N	44 1/3	41 1/3	43 1/3
267	5 N	7 N	4 N	11 N	43 1/3	45 1/3	46 1/3	42 1/3
268	25 N	25 N	22 N	36 N	85 2/3	91 2/3	86 2/3	84 2/3
269	10 N	9 N	7 N	16 N	74 1/2	79 2/3	79 2/3	82 2/3
270	0 N	6 N	2 N	3 N	50 1/3	59 1/2	62 1/2	61 1/2
271	5 N	5 N	2 N	5 N	31 N	39 1/3	30 N	32 N
272	10 N	25 N	22 N	39 N	92 2/3	93 2/3	88 2/3	91 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
273	25 N	75 2/3	80 2/3	87 2/3	83 2/3	90 2/3	91 2/3	97 2/3
274	24 N	77 2/3	80 2/3	93 2/3	82 2/3	87 2/3	89 2/3	97 2/3
275	15 N	75 2/3	75 1/2	84 2/3	73 1/2	80 2/3	83 2/3	87 2/3
276	15 N	66 1/2	63 1/2	74 1/2	60 1/2	73 2/3	82 2/3	74 1/2
277	30 N	67 1/2	73 1/2	82 2/3	78 2/3	83 2/3	88 2/3	82 2/3
278	20 N	50 1/3	45 1/3	59 1/3	62 1/2	62 1/2	67 1/2	68 1/2
279	25 N	51 1/3	48 1/3	64 1/2	66 1/2	75 2/3	77 2/3	76 2/3
280	20 N	37 N	30 N	36 N	54 1/3	63 1/2	62 1/2	65 1/2
281	20 N	36 N	50 1/3	58 1/3	53 1/3	57 1/2	55 1/3	67 1/2
282	40 N	53 1/3	57 1/3	69 1/2	87 2/3	89 2/3	88 2/3	89 2/3
283	20 N	23 N	31 N	31 N	40 N	36 N	43 1/3	61 1/2
284	20 N	30 N	41 N	64 1/2	31 N	41 1/3	50 1/3	58 1/3
285	20 N	25 N	36 N	38 N	47 1/3	57 1/2	58 1/2	71 1/2
286	15 N	29 N	27 N	34 N	64 1/2	78 2/3	75 2/3	84 2/3
287	25 N	17 N	9 N	26 N	46 1/3	48 1/3	41 1/3	56 1/3
288	40 N	56 1/3	45 1/3	48 1/3	58 1/3	71 2/3	68 1/2	78 2/3
289	30 N	43 1/3	58 1/3	67 1/2	26 N	26 N	28 N	46 1/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
290	5 N	25 N	31 N	33 N	40 N	44 1/3	43 1/3	62 1/2
291	N	N	N	N	N	N	N	N
292a	70 1/2	91 2/3	93 2/3	90 2/3	70 1/2	80 2/3	76 2/3	66 1/2
292b	75 1/2	90 2/3	86 2/3	85 2/3	97 2/3	93 2/3	91 2/3	94 2/3
292c	60 1/3	91 2/3	90 2/3	87 2/3	97 2/3	95 2/3	94 2/3	92 2/3
292d	55 1/3	68 1/2	72 1/2	59 1/3	99 2/3	96 2/3	95 2/3	94 2/3
292e	35 N	45 1/3	41 N	64 1/2	97 2/3	94 2/3	93 2/3	96 2/3
292f	30 N	26 N	23 N	36 N	96 2/3	94 2/3	93 2/3	96 2/3
292g	40 N	50 1/3	37 N	69 1/2	96 2/3	94 2/3	95 2/3	96 2/3
293a	65 1/3	90 2/3	91 2/3	87 2/3	66 1/2	74 2/3	77 2/3	68 1/2
293b	70 1/2	87 2/3	91 2/3	84 2/3	97 2/3	92 2/3	91 2/3	90 2/3
293c	65 1/3	88 2/3	89 2/3	87 2/3	94 2/3	92 2/3	92 2/3	88 2/3
293d	55 1/3	64 1/2	75 1/2	54 1/3	96 2/3	93 2/3	89 2/3	93 2/3
293e	40 N	46 1/3	38 N	67 1/2	97 2/3	95 2/3	92 2/3	95 2/3
293f	20 N	28 N	22 N	30 N	94 2/3	92 2/3	91 2/3	91 2/3
293g	35 N	41 1/3	34 N	61 1/3	94 2/3	92 2/3	93 2/3	93 2/3
294a	90 2/3	92 2/3	86 2/3	90 2/3	57 1/3	67 1/2	65 1/2	54 1/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
294b	80 1/2	80 2/3	83 2/3	79 2/3	68 1/2	69 1/2	71 1/2	63 1/2
294c	75 1/2	88 2/3	85 2/3	82 2/3	69 1/2	77 2/3	72 1/2	69 1/2
294d	60 1/3	62 1/2	71 1/2	51 1/3	73 1/2	74 2/3	72 1/2	72 1/2
294e	20 N	33 N	30 N	49 1/3	57 1/3	64 1/2	70 1/2	63 1/2
294f	10 N	17 N	16 N	26 N	60 1/2	66 1/2	66 1/2	68 1/2
294g	20 N	30 N	22 N	38 N	61 1/2	66 1/2	63 1/2	63 1/2
295a	25 N	69 1/2	76 1/2	82 2/3	77 2/3	74 2/3	72 1/2	76 2/3
295b	30 N	68 1/2	74 1/2	69 1/2	92 2/3	93 2/3	91 2/3	95 2/3
295c	30 N	65 1/2	76 1/2	74 1/2	92 2/3	93 2/3	93 2/3	93 2/3
295d	20 N	45 1/3	46 1/3	49 1/3	90 2/3	94 2/3	90 2/3	95 2/3
295e	25 N	33 N	33 N	51 1/3	92 2/3	95 2/3	92 2/3	97 2/3
295f	15 N	19 N	22 N	33 N	90 2/3	95 2/3	92 2/3	95 2/3
295g	15 N	32 N	25 N	38 N	91 2/3	95 2/3	92 2/3	96 2/3
296a	25 N	78 2/3	78 2/3	92 2/3	48 1/3	62 1/2	63 1/2	68 1/2
296b	25 N	73 2/3	74 1/2	87 2/3	58 1/3	80 2/3	84 2/3	89 2/3
296c	30 N	64 1/2	81 2/3	85 2/3	57 1/3	80 2/3	85 2/3	86 2/3
296d	20 N	49 1/3	55 1/3	56 1/3	57 1/3	82 2/3	85 2/3	87 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
296e	20 N	34 N	31 N	48 1/3	59 1/3	80 2/3	85 2/3	86 2/3
296f	15 N	18 N	24 N	23 N	60 1/2	79 2/3	82 2/3	86 2/3
296g	15 N	30 N	27 N	51 1/3	58 1/3	82 2/3	84 2/3	90 2/3
297a	35 N	69 1/2	61 1/2	75 1/2	47 1/3	60 1/2	57 1/2	62 1/2
297b	30 N	65 1/2	62 1/2	69 1/2	76 2/3	76 2/3	74 2/3	84 2/3
297c	40 N	70 1/2	65 1/2	75 1/2	71 1/2	78 2/3	75 2/3	83 2/3
297d	35 N	40 1/3	41 N	46 1/3	69 1/2	77 2/3	76 2/3	82 2/3
297e	30 N	31 N	27 N	44 N	71 1/2	78 2/3	76 2/3	85 2/3
297f	15 N	18 N	17 N	20 N	70 1/2	75 2/3	78 2/3	82 2/3
297g	15 N	25 N	18 N	34 N	72 1/2	75 2/3	75 2/3	82 2/3
298a	60 1/3	87 2/3	86 2/3	87 2/3	71 1/2	78 2/3	74 2/3	68 1/2
298b	55 1/3	81 2/3	84 2/3	82 2/3	93 2/3	89 2/3	90 2/3	90 2/3
298c	65 1/3	85 2/3	86 2/3	76 1/2	86 2/3	92 2/3	90 2/3	87 2/3
298d	60 1/3	58 1/2	62 1/2	49 1/3	86 2/3	92 2/3	87 2/3	89 2/3
298e	40 N	42 1/3	32 N	50 1/3	91 2/3	92 2/3	91 2/3	89 2/3
298f	25 N	20 N	20 N	18 N	90 2/3	92 2/3	90 2/3	91 2/3
298g	35 N	40 1/3	27 N	43 N	90 2/3	94 2/3	91 2/3	92 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
299a	80 1/2	92 2/3	91 2/3	92 2/3	56 1/3	66 1/2	56 1/3	55 1/3
299b	65 1/3	84 2/3	88 2/3	87 2/3	57 1/3	68 1/2	70 1/2	62 1/2
299c	65 1/3	89 2/3	86 2/3	85 2/3	57 1/3	69 1/2	68 1/2	67 1/2
299d	45 N	62 1/2	60 1/3	59 1/3	52 1/3	70 1/2	69 1/2	66 1/2
299e	30 N	37 N	23 N	48 1/3	52 1/3	62 1/2	67 1/2	59 1/2
299f	30 N	18 N	18 N	18 N	52 1/3	67 1/2	68 1/2	64 1/2
299g	25 N	32 N	19 N	35 N	52 1/3	61 1/2	65 1/2	61 1/2
300a	75 1/2	91 2/3	93 2/3	90 2/3	60 1/2	74 2/3	65 1/2	66 1/2
300b	65 1/3	87 2/3	90 2/3	85 2/3	65 1/2	74 2/3	77 2/3	77 2/3
300c	70 1/2	86 2/3	89 2/3	84 2/3	57 1/3	72 2/3	73 1/2	73 1/2
300d	55 1/3	62 1/2	60 1/3	56 1/3	57 1/3	71 2/3	73 1/2	74 1/2
300e	30 N	37 N	30 N	49 1/3	58 1/3	66 1/2	71 1/2	72 1/2
300f	20 N	18 N	17 N	18 N	59 1/3	69 1/2	71 1/2	65 1/2
300g	25 N	30 N	23 N	35 N	57 1/3	68 1/2	70 1/2	65 1/2
301a	70 1/2	93 2/3	93 2/3	89 2/3	57 1/3	63 1/2	57 1/2	52 1/3
301b	60 1/3	86 2/3	88 2/3	82 2/3	60 1/2	65 1/2	70 1/2	65 1/2
301c	55 1/3	85 2/3	87 2/3	84 2/3	57 1/3	64 1/2	67 1/2	61 1/2

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
301d	40 N	59 1/2	60 1/3	48 1/3	55 1/3	64 1/2	66 1/2	62 1/2
301e	25 N	36 N	30 N	43 N	57 1/3	60 1/2	64 1/2	64 1/2
301f	20 N	18 N	19 N	21 N	59 1/3	63 1/2	63 1/2	63 1/2
301g	20 N	30 N	25 N	36 N	58 1/3	61 1/2	65 1/2	61 1/2
302a	15 N	45 1/3	47 1/3	46 1/3	27 N	30 N	32 N	39 N
302b	15 N	41 1/3	37 N	46 1/3	60 1/2	59 1/2	56 1/3	57 1/3
302c	10 N	38 N	41 N	38 N	47 1/3	55 1/2	56 1/3	54 1/3
302d	5 N	29 N	30 N	26 N	51 1/3	54 1/3	57 1/2	56 1/3
302e	15 N	21 N	16 N	28 N	58 1/3	62 1/2	65 1/2	60 1/2
302f	5 N	13 N	12 N	18 N	58 1/3	58 1/2	60 1/2	59 1/2
302g	5 N	21 N	17 N	31 N	58 1/3	63 1/2	69 1/2	63 1/2
303a	5 N	35 N	26 N	46 1/3	26 N	30 N	28 N	35 N
303b	5 N	33 N	19 N	46 1/3	57 1/3	52 1/3	48 1/3	53 1/3
303c	5 N	28 N	27 N	39 N	46 1/3	48 1/3	47 1/3	50 1/3
303d	0 N	22 N	20 N	28 N	46 1/3	49 1/3	46 1/3	52 1/3
303e	0 N	19 N	9 N	25 N	52 1/3	56 1/2	55 1/3	58 1/3
303f	0 N	9 N	9 N	16 N	55 1/3	52 1/3	50 1/3	55 1/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
303g	0 N	16 N	12 N	26 N	52 1/3	57 1/2	55 1/3	57 1/3
304a	20 N	56 1/3	64 1/2	56 1/3	19 N	17 N	26 N	28 N
304b	10 N	51 1/3	60 1/3	46 1/3	42 N	37 N	45 1/3	48 1/3
304c	15 N	45 1/3	59 1/3	46 1/3	28 N	31 N	41 1/3	49 1/3
304d	10 N	29 N	39 N	23 N	30 N	34 N	42 1/3	49 1/3
304e	10 N	21 N	16 N	25 N	32 N	38 1/3	45 1/3	52 1/3
304f	5 N	9 N	10 N	13 N	34 N	33 N	46 1/3	48 1/3
304g	5 N	20 N	15 N	23 N	39 N	42 1/3	55 1/3	52 1/3
305a	15 N	49 1/3	47 1/3	41 N	47 1/3	55 1/2	52 1/3	56 1/3
305b	15 N	42 1/3	43 N	41 N	80 2/3	74 2/3	72 1/2	70 1/2
305c	15 N	43 1/3	48 1/3	46 1/3	63 1/2	76 2/3	68 1/2	73 1/2
305d	15 N	20 N	25 N	26 N	63 1/2	74 2/3	68 1/2	70 1/2
305e	15 N	20 N	16 N	20 N	79 2/3	79 2/3	75 2/3	74 1/2
305f	15 N	10 N	11 N	13 N	79 2/3	77 2/3	73 1/2	74 1/2
305g	15 N	16 N	11 N	18 N	76 2/3	76 2/3	75 2/3	75 1/2
306a	5 N	14 N	20 N	23 N	32 N	36 N	36 N	44 1/3
306b	5 N	12 N	16 N	25 N	60 1/2	61 1/2	57 1/2	66 1/2

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
306c	5 N	15 N	24 N	23 N	49 1/3	64 1/2	55 1/3	69 1/2
306d	5 N	9 N	14 N	21 N	52 1/3	64 1/2	61 1/2	78 2/3
306e	5 N	8 N	9 N	16 N	57 1/3	64 1/2	61 1/2	66 1/2
306f	5 N	8 N	4 N	11 N	55 1/3	62 1/2	60 1/2	68 1/2
306g	5 N	9 N	2 N	13 N	57 1/3	65 1/2	66 1/2	75 1/2
307a	10 N	23 N	10 N	31 N	30 N	32 N	27 N	35 N
307b	5 N	22 N	13 N	25 N	51 1/3	48 1/3	45 1/3	47 1/3
307c	10 N	24 N	10 N	23 N	47 1/3	49 1/3	46 1/3	51 1/3
307d	15 N	12 N	9 N	13 N	46 1/3	48 1/3	45 1/3	49 1/3
307e	5 N	11 N	7 N	16 N	50 1/3	51 1/3	46 1/3	50 1/3
307f	0 N	7 N	4 N	11 N	48 1/3	48 1/3	47 1/3	51 1/3
307g	0 N	11 N	4 N	16 N	45 1/3	51 1/3	46 1/3	53 1/3
308a	20 N	59 1/2	57 1/3	66 1/2	42 N	42 1/3	43 1/3	47 1/3
308b	20 N	54 1/3	55 1/3	61 1/3	55 1/3	57 1/2	55 1/3	67 1/2
308c	20 N	57 1/2	57 1/3	64 1/2	49 1/3	60 1/2	56 1/3	65 1/2
308d	20 N	36 N	41 N	28 N	50 1/3	61 1/2	57 1/2	68 1/2
308e	10 N	26 N	17 N	26 N	54 1/3	64 1/2	63 1/2	71 1/2

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
308f	10 N	14 N	13 N	12 N	54 1/3	63 1/2	58 1/2	72 1/2
308g	10 N	22 N	13 N	28 N	49 1/3	62 1/2	60 1/2	69 1/2
309a	45 N	82 2/3	88 2/3	84 2/3	52 1/3	56 1/2	53 1/3	59 1/2
309b	40 N	68 1/2	79 2/3	69 1/2	62 1/2	64 1/2	65 1/2	72 1/2
309c	40 N	83 2/3	88 2/3	82 2/3	64 1/2	77 2/3	70 1/2	78 2/3
309d	40 N	60 1/2	59 1/3	41 N	62 1/2	75 2/3	70 1/2	75 1/2
309e	20 N	33 N	29 N	41 N	55 1/3	66 1/2	65 1/2	75 1/2
309f	25 N	15 N	18 N	21 N	53 1/3	60 1/2	59 1/2	75 1/2
309g	20 N	23 N	23 N	33 N	54 1/3	62 1/2	64 1/2	73 1/2
310a	5 N	53 1/3	41 N	48 1/3	34 N	45 1/3	34 N	40 N
310b	10 N	44 1/3	35 N	46 1/3	35 N	49 1/3	41 1/3	54 1/3
310c	10 N	51 1/3	45 1/3	41 N	40 N	53 1/3	43 1/3	51 1/3
310d	10 N	31 N	19 N	23 N	35 N	54 1/3	44 1/3	55 1/3
310e	0 N	16 N	13 N	18 N	32 N	47 1/3	40 1/3	50 1/3
310f	0 N	10 N	10 N	6 N	36 N	48 1/3	41 1/3	50 1/3
310g	0 N	15 N	7 N	13 N	26 N	47 1/3	39 N	48 1/3
311a	20 N	54 1/3	50 1/3	56 1/3	56 1/3	61 1/2	58 1/2	61 1/2

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
311b	20 N	42 1/3	41 N	48 1/3	68 1/2	74 2/3	68 1/2	81 2/3
311c	20 N	56 1/3	59 1/3	56 1/3	65 1/2	79 2/3	78 2/3	80 2/3
311d	15 N	38 N	37 N	23 N	68 1/2	80 2/3	79 2/3	83 2/3
311e	20 N	20 N	18 N	28 N	61 1/2	75 2/3	70 1/2	78 2/3
311f	10 N	12 N	9 N	16 N	65 1/2	77 2/3	69 1/2	81 2/3
311g	15 N	19 N	11 N	21 N	65 1/2	79 2/3	75 2/3	81 2/3
312a	60 1/3	90 2/3	84 2/3	87 2/3	74 1/2	79 2/3	72 1/2	80 2/3
312b	50 N	83 2/3	82 2/3	82 2/3	88 2/3	88 2/3	85 2/3	97 2/3
312c	50 N	88 2/3	86 2/3	80 2/3	81 2/3	93 2/3	88 2/3	95 2/3
312d	45 N	62 1/2	54 1/3	48 1/3	84 2/3	92 2/3	89 2/3	95 2/3
312e	25 N	41 1/3	34 N	38 N	90 2/3	92 2/3	87 2/3	95 2/3
312f	20 N	22 N	23 N	25 N	86 2/3	92 2/3	86 2/3	93 2/3
312g	20 N	38 N	25 N	39 N	89 2/3	91 2/3	90 2/3	96 2/3
313a	20 N	62 1/2	54 1/3	59 1/3	73 1/2	74 2/3	67 1/2	77 2/3
313b	20 N	55 1/3	53 1/3	58 1/3	92 2/3	87 2/3	83 2/3	96 2/3
313c	20 N	59 1/2	57 1/3	54 1/3	86 2/3	90 2/3	86 2/3	94 2/3
313d	20 N	43 1/3	34 N	33 N	89 2/3	88 2/3	86 2/3	96 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
313e	20 N	26 N	15 N	25 N	92 2/3	93 2/3	89 2/3	99 2/3
313f	10 N	19 N	18 N	18 N	92 2/3	91 2/3	90 2/3	98 2/3
313g	15 N	25 N	14 N	26 N	90 2/3	91 2/3	89 2/3	99 2/3
314a	60 1/3	57 1/2	48 1/3	46 1/3	6 N	12 N	15 N	11 N
314b	50 N	49 1/3	43 N	36 N	5 N	9 N	11 N	13 N
314c	40 N	51 1/3	41 N	44 N	5 N	10 N	14 N	14 N
314d	25 N	30 N	25 N	23 N	5 N	11 N	13 N	13 N
314e	10 N	12 N	8 N	21 N	6 N	7 N	7 N	12 N
314f	0 N	6 N	6 N	11 N	6 N	6 N	9 N	12 N
314g	10 N	11 N	6 N	16 N	6 N	6 N	8 N	11 N
315a	80 1/2	92 2/3	87 2/3	88 2/3	49 1/3	60 1/2	63 1/2	57 1/3
315b	75 1/2	87 2/3	85 2/3	85 2/3	51 1/3	61 1/2	65 1/2	63 1/2
315c	45 N	90 2/3	87 2/3	77 1/2	53 1/3	62 1/2	71 1/2	63 1/2
315d	50 N	62 1/2	59 1/3	49 1/3	50 1/3	59 1/2	66 1/2	64 1/2
315e	25 N	34 N	24 N	46 1/3	49 1/3	54 1/3	55 1/3	57 1/3
315f	10 N	15 N	11 N	24 N	51 1/3	53 1/3	55 1/3	56 1/3
315g	15 N	25 N	18 N	33 N	48 1/3	53 1/3	56 1/3	57 1/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
316a	85 2/3	91 2/3	89 2/3	88 2/3	43 1/3	49 1/3	49 1/3	44 1/3
316b	75 1/2	85 2/3	84 2/3	80 2/3	47 1/3	53 1/3	55 1/3	49 1/3
316c	60 1/3	83 2/3	86 2/3	79 2/3	37 N	49 1/3	55 1/3	57 1/3
316d	35 N	56 1/3	55 1/3	51 1/3	40 N	50 1/3	51 1/3	54 1/3
316e	20 N	32 N	14 N	35 N	35 N	41 1/3	41 1/3	44 1/3
316f	10 N	12 N	5 N	18 N	35 N	37 N	44 1/3	44 1/3
316g	15 N	20 N	11 N	30 N	38 N	39 1/3	41 1/3	43 1/3
317a	25 N	29 N	29 N	41 N	16 N	16 N	15 N	17 N
317b	25 N	26 N	18 N	30 N	17 N	22 N	22 N	22 N
317c	15 N	24 N	23 N	30 N	15 N	21 N	17 N	18 N
317d	15 N	13 N	9 N	13 N	15 N	19 N	17 N	18 N
317e	10 N	9 N	4 N	13 N	17 N	21 N	19 N	19 N
317f	5 N	7 N	6 N	8 N	17 N	19 N	18 N	20 N
317g	10 N	10 N	4 N	15 N	13 N	21 N	19 N	21 N
318a	25 N	47 1/3	47 1/3	93 2/3	37 N	42 1/3	30 N	74 1/2
318b	20 N	41 1/3	42 N	95 2/3	49 1/3	48 1/3	36 N	95 2/3
318c	20 N	45 1/3	49 1/3	95 2/3	46 1/3	49 1/3	34 N	96 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
318d	15 N	29 N	27 N	59 1/3	46 1/3	50 1/3	36 N	97 2/3
318e	20 N	21 N	9 N	58 1/3	46 1/3	49 1/3	35 N	96 2/3
318f	15 N	11 N	6 N	34 N	48 1/3	49 1/3	36 N	96 2/3
318g	10 N	20 N	9 N	54 1/3	44 1/3	49 1/3	46 1/3	97 2/3
319a	30 N	55 1/3	60 1/3	92 2/3	30 N	38 1/3	31 N	73 1/2
319b	30 N	48 1/3	53 1/3	92 2/3	31 N	42 1/3	35 N	85 2/3
319c	25 N	49 1/3	55 1/3	95 2/3	29 N	41 1/3	35 N	86 2/3
319d	15 N	32 N	33 N	59 1/3	31 N	43 1/3	35 N	86 2/3
319e	20 N	20 N	13 N	49 1/3	31 N	40 1/3	35 N	85 2/3
319f	20 N	9 N	8 N	25 N	31 N	40 1/3	33 N	86 2/3
319g	15 N	17 N	11 N	46 1/3	31 N	39 1/3	34 N	83 2/3
320a	20 N	42 1/3	54 1/3	93 2/3	28 N	32 N	29 N	69 1/2
320b	20 N	36 N	47 1/3	93 2/3	29 N	36 N	33 N	85 2/3
320c	10 N	38 N	52 1/3	92 2/3	29 N	37 N	34 N	87 2/3
320d	0 N	23 N	31 N	56 1/3	29 N	37 N	34 N	89 2/3
320e	0 N	15 N	11 N	51 1/3	29 N	36 N	33 N	88 2/3
320f	0 N	7 N	8 N	28 N	29 N	36 N	34 N	88 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
320g	0 N	13 N	11 N	49 1/3	29 N	36 N	32 N	86 2/3
321a	15 N	29 N	38 N	69 1/2	31 N	34 N	28 N	66 1/2
321b	15 N	27 N	33 N	69 1/2	34 N	39 1/3	32 N	78 2/3
321c	10 N	26 N	38 N	67 1/2	35 N	40 1/3	33 N	80 2/3
321d	5 N	17 N	24 N	41 N	34 N	40 1/3	33 N	80 2/3
321e	5 N	13 N	8 N	38 N	35 N	39 1/3	33 N	78 2/3
321f	5 N	6 N	4 N	25 N	34 N	39 1/3	33 N	78 2/3
321g	5 N	11 N	7 N	38 N	34 N	38 1/3	33 N	78 2/3
322a	40 N	66 1/2	45 1/3	82 2/3	66 1/2	70 1/2	61 1/2	80 2/3
322b	40 N	62 1/2	41 N	82 2/3	70 1/2	72 2/3	62 1/2	90 2/3
322c	40 N	61 1/2	46 1/3	82 2/3	65 1/2	72 2/3	63 1/2	90 2/3
322d	25 N	42 1/3	37 N	59 1/3	65 1/2	71 2/3	63 1/2	90 2/3
322e	20 N	29 N	23 N	48 1/3	65 1/2	65 1/2	58 1/2	85 2/3
322f	15 N	17 N	17 N	31 N	68 1/2	67 1/2	61 1/2	85 2/3
322g	20 N	22 N	17 N	44 N	65 1/2	66 1/2	56 1/3	85 2/3
323a	20 N	41 1/3	38 N	59 1/3	24 N	41 1/3	46 1/3	48 1/3
323b	20 N	36 N	34 N	53 1/3	36 N	40 1/3	42 1/3	48 1/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
323c	20 N	36 N	38 N	49 1/3	25 N	43 1/3	45 1/3	56 1/3
323d	10 N	20 N	21 N	25 N	26 N	40 1/3	42 1/3	46 1/3
323e	10 N	13 N	13 N	23 N	26 N	36 N	36 N	41 N
323f	5 N	8 N	8 N	20 N	28 N	37 N	34 N	40 N
323g	15 N	12 N	9 N	23 N	27 N	36 N	38 N	42 1/3
324a	15 N	67 1/2	61 1/2	80 2/3	49 1/3	57 1/2	53 1/3	68 1/2
324b	20 N	56 1/3	54 1/3	77 1/2	55 1/3	62 1/2	60 1/2	73 1/2
324c	20 N	55 1/3	53 1/3	74 1/2	54 1/3	63 1/2	62 1/2	74 1/2
324d	20 N	32 N	30 N	40 N	53 1/3	65 1/2	60 1/2	76 2/3
324e	10 N	21 N	19 N	38 N	58 1/3	64 1/2	61 1/2	68 1/2
324f	5 N	12 N	11 N	23 N	61 1/2	65 1/2	61 1/2	72 1/2
324g	15 N	17 N	9 N	36 N	55 1/3	61 1/2	56 1/3	70 1/2
325a	10 N	8 N	5 N	7 N	12 N	13 N	11 N	19 N
325b	10 N	9 N	4 N	8 N	16 N	19 N	21 N	33 N
325c	10 N	8 N	4 N	8 N	13 N	20 N	23 N	35 N
325d	5 N	6 N	2 N	8 N	13 N	18 N	25 N	32 N
325e	5 N	4 N	2 N	3 N	14 N	18 N	23 N	35 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
325f	0 N	3 N	2 N	3 N	14 N	18 N	25 N	39 N
325g	5 N	1 N	2 N	3 N	14 N	19 N	22 N	34 N
326a	5 N	9 N	6 N	8 N	18 N	19 N	14 N	15 N
326b	5 N	10 N	7 N	8 N	20 N	26 N	19 N	23 N
326c	5 N	8 N	7 N	8 N	17 N	24 N	22 N	24 N
326d	5 N	8 N	4 N	8 N	17 N	25 N	24 N	23 N
326e	5 N	7 N	6 N	3 N	18 N	25 N	22 N	25 N
326f	0 N	3 N	6 N	3 N	19 N	26 N	26 N	27 N
326g	5 N	3 N	4 N	3 N	15 N	25 N	23 N	26 N
327a	5 N	11 N	6 N	20 N	19 N	23 N	17 N	22 N
327b	5 N	10 N	6 N	18 N	20 N	30 N	26 N	29 N
327c	5 N	10 N	12 N	18 N	20 N	28 N	26 N	34 N
327d	5 N	7 N	8 N	10 N	20 N	28 N	27 N	31 N
327e	5 N	5 N	4 N	5 N	20 N	29 N	26 N	33 N
327f	0 N	2 N	2 N	5 N	20 N	29 N	25 N	34 N
327g	5 N	6 N	2 N	8 N	20 N	28 N	26 N	29 N
328a	50 N	54 1/3	50 1/3	46 1/3	38 N	38 1/3	34 N	28 N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
328b	45 N	48 1/3	45 1/3	51 1/3	48 1/3	45 1/3	44 1/3	38 N
328c	45 N	49 1/3	50 1/3	49 1/3	40 N	44 1/3	44 1/3	39 N
328d	35 N	29 N	25 N	21 N	41 N	44 1/3	43 1/3	39 N
328e	20 N	19 N	14 N	18 N	40 N	45 1/3	48 1/3	40 N
328f	15 N	8 N	6 N	13 N	43 1/3	40 1/3	43 1/3	34 N
328g	15 N	19 N	8 N	20 N	37 N	42 1/3	47 1/3	32 N
329a	35 N	82 2/3	75 1/2	80 2/3	54 1/3	61 1/2	56 1/3	62 1/2
329b	35 N	77 2/3	72 1/2	79 2/3	74 1/2	76 2/3	74 2/3	82 2/3
329c	35 N	76 2/3	73 1/2	82 2/3	68 1/2	77 2/3	77 2/3	85 2/3
329d	30 N	48 1/3	45 1/3	46 1/3	70 1/2	77 2/3	77 2/3	86 2/3
329e	15 N	28 N	18 N	40 N	68 1/2	78 2/3	77 2/3	83 2/3
329f	5 N	13 N	13 N	26 N	71 1/2	74 2/3	74 2/3	84 2/3
329g	15 N	23 N	14 N	30 N	66 1/2	77 2/3	75 2/3	83 2/3
330a	50 N	88 2/3	83 2/3	92 2/3	61 1/2	75 2/3	73 1/2	74 1/2
330b	55 1/3	85 2/3	79 2/3	87 2/3	80 2/3	86 2/3	84 2/3	92 2/3
330c	50 N	89 2/3	78 2/3	90 2/3	72 1/2	88 2/3	88 2/3	93 2/3
330d	50 N	56 1/3	57 1/3	57 1/3	75 1/2	89 2/3	86 2/3	93 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
330e	30 N	35 N	30 N	51 1/3	80 2/3	88 2/3	89 2/3	93 2/3
330f	10 N	18 N	12 N	25 N	79 2/3	86 2/3	86 2/3	91 2/3
330g	25 N	29 N	19 N	41 N	82 2/3	88 2/3	90 2/3	94 2/3
331a	25 N	48 1/3	35 N	69 1/2	42 N	50 1/3	42 1/3	49 1/3
331b	30 N	45 1/3	30 N	67 1/2	58 1/3	56 1/2	51 1/3	63 1/2
331c	30 N	47 1/3	36 N	67 1/2	52 1/3	57 1/2	52 1/3	66 1/2
331d	25 N	25 N	19 N	36 N	52 1/3	57 1/2	52 1/3	65 1/2
331e	15 N	19 N	11 N	31 N	57 1/3	56 1/2	54 1/3	65 1/2
331f	15 N	9 N	4 N	16 N	54 1/3	56 1/2	50 1/3	65 1/2
331g	10 N	16 N	7 N	31 N	54 1/3	55 1/2	52 1/3	62 1/2
332a	15 N	42 1/3	32 N	40 N	34 N	42 1/3	32 N	39 N
332b	15 N	37 N	32 N	39 N	46 1/3	46 1/3	35 N	49 1/3
332c	20 N	36 N	35 N	38 N	42 N	48 1/3	44 1/3	47 1/3
332d	20 N	22 N	20 N	20 N	40 N	46 1/3	34 N	47 1/3
332e	10 N	16 N	13 N	18 N	44 1/3	47 1/3	33 N	47 1/3
332f	10 N	10 N	6 N	8 N	41 N	44 1/3	34 N	47 1/3
332g	15 N	16 N	9 N	16 N	40 N	46 1/3	35 N	46 1/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
333a	75 1/2	88 2/3	83 2/3	82 2/3	57 1/3	70 1/2	67 1/2	63 1/2
333b	70 1/2	81 2/3	76 1/2	74 1/2	77 2/3	81 2/3	75 2/3	80 2/3
333c	55 1/3	80 2/3	82 2/3	77 1/2	74 1/2	83 2/3	79 2/3	80 2/3
333d	50 N	56 1/3	50 1/3	41 N	76 2/3	84 2/3	77 2/3	80 2/3
333e	35 N	36 N	25 N	40 N	79 2/3	85 2/3	79 2/3	78 2/3
333f	15 N	20 N	14 N	21 N	77 2/3	83 2/3	76 2/3	76 2/3
333g	25 N	30 N	19 N	33 N	74 1/2	86 2/3	79 2/3	78 2/3
334a	35 N	78 2/3	76 1/2	80 2/3	31 N	47 1/3	49 1/3	53 1/3
334b	25 N	69 1/2	72 1/2	66 1/2	35 N	53 1/3	59 1/2	69 1/2
334c	30 N	76 2/3	77 2/3	72 1/2	34 N	57 1/2	63 1/2	72 1/2
334d	30 N	49 1/3	50 1/3	33 N	32 N	58 1/2	62 1/2	72 1/2
334e	20 N	30 N	23 N	36 N	37 N	56 1/2	61 1/2	72 1/2
334f	5 N	16 N	13 N	20 N	37 N	53 1/3	56 1/3	72 1/2
334g	10 N	28 N	17 N	33 N	38 N	55 1/2	57 1/2	72 1/2
335a	35 N	83 2/3	78 2/3	87 2/3	56 1/3	62 1/2	59 1/2	64 1/2
335b	35 N	76 2/3	73 1/2	82 2/3	68 1/2	74 2/3	75 2/3	81 2/3
335c	35 N	81 2/3	77 2/3	82 2/3	64 1/2	77 2/3	78 2/3	84 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
335d	30 N	52 1/3	52 1/3	41 N	62 1/2	77 2/3	78 2/3	85 2/3
335e	15 N	34 N	27 N	46 1/3	65 1/2	78 2/3	81 2/3	87 2/3
335f	5 N	23 N	15 N	23 N	70 1/2	73 2/3	76 2/3	86 2/3
335g	15 N	32 N	19 N	39 N	65 1/2	76 2/3	75 2/3	82 2/3
336a	30 N	79 2/3	71 1/2	80 2/3	52 1/3	56 1/2	57 1/2	57 1/3
336b	25 N	73 2/3	74 1/2	67 1/2	66 1/2	69 1/2	69 1/2	74 1/2
336c	30 N	75 2/3	64 1/2	75 1/2	58 1/3	70 1/2	66 1/2	80 2/3
336d	30 N	44 1/3	43 N	33 N	58 1/3	69 1/2	67 1/2	83 2/3
336e	20 N	31 N	21 N	39 N	66 1/2	73 2/3	75 2/3	82 2/3
336f	10 N	19 N	11 N	18 N	66 1/2	70 1/2	69 1/2	79 2/3
336g	20 N	31 N	17 N	31 N	64 1/2	72 2/3	70 1/2	74 1/2
337a	35 N	84 2/3	80 2/3	85 2/3	33 N	51 1/3	39 N	51 1/3
337b	35 N	67 1/2	64 1/2	76 1/2	37 N	54 1/3	54 1/3	62 1/2
337c	30 N	83 2/3	81 2/3	82 2/3	42 N	63 1/2	60 1/2	74 1/2
337d	35 N	53 1/3	52 1/3	46 1/3	42 N	65 1/2	61 1/2	74 1/2
337e	15 N	28 N	21 N	41 N	39 N	54 1/3	51 1/3	66 1/2
337f	0 N	14 N	9 N	23 N	38 N	50 1/3	48 1/3	65 1/2

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
337g	10 N	26 N	14 N	33 N	36 N	53 1/3	49 1/3	60 1/2
338a	25 N	75 2/3	73 1/2	67 1/2	38 N	52 1/3	55 1/3	58 1/3
338b	20 N	69 1/2	67 1/2	62 1/3	48 1/3	61 1/2	73 1/2	72 1/2
338c	15 N	70 1/2	69 1/2	62 1/3	42 N	62 1/2	66 1/2	74 1/2
338d	20 N	44 1/3	45 1/3	34 N	40 N	62 1/2	66 1/2	75 1/2
338e	10 N	31 N	25 N	31 N	49 1/3	66 1/2	74 2/3	77 2/3
338f	0 N	16 N	14 N	20 N	51 1/3	66 1/2	70 1/2	78 2/3
338g	10 N	26 N	16 N	28 N	47 1/3	66 1/2	69 1/2	74 1/2
339a	65 1/3	91 2/3	84 2/3	90 2/3	77 2/3	80 2/3	79 2/3	78 2/3
339b	55 1/3	85 2/3	82 2/3	87 2/3	86 2/3	88 2/3	84 2/3	90 2/3
339c	45 N	86 2/3	83 2/3	87 2/3	80 2/3	91 2/3	91 2/3	90 2/3
339d	35 N	53 1/3	50 1/3	49 1/3	80 2/3	84 2/3	85 2/3	87 2/3
339e	20 N	38 N	28 N	43 N	78 2/3	85 2/3	84 2/3	89 2/3
339f	15 N	18 N	20 N	18 N	79 2/3	83 2/3	84 2/3	85 2/3
339g	15 N	30 N	24 N	28 N	80 2/3	79 2/3	81 2/3	86 2/3
340a	50 N	79 2/3	82 2/3	79 2/3	63 1/2	65 1/2	60 1/2	68 1/2
340b	65 1/3	70 1/2	75 1/2	72 1/2	83 2/3	80 2/3	76 2/3	83 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
340c	55 1/3	72 1/2	84 2/3	85 2/3	77 2/3	88 2/3	88 2/3	90 2/3
340d	45 N	45 1/3	50 1/3	46 1/3	75 1/2	82 2/3	80 2/3	86 2/3
340e	25 N	30 N	26 N	43 N	76 2/3	81 2/3	75 2/3	87 2/3
340f	15 N	13 N	18 N	15 N	77 2/3	76 2/3	71 1/2	82 2/3
340g	20 N	24 N	22 N	26 N	69 1/2	72 2/3	70 1/2	74 1/2
341a	25 N	39 N	43 N	54 1/3	28 N	37 N	37 N	52 1/3
341b	20 N	37 N	47 1/3	49 1/3	36 N	46 1/3	50 1/3	70 1/2
341c	20 N	37 N	45 1/3	44 N	34 N	47 1/3	50 1/3	67 1/2
341d	15 N	22 N	31 N	31 N	34 N	51 1/3	53 1/3	70 1/2
341e	5 N	15 N	15 N	28 N	36 N	48 1/3	48 1/3	70 1/2
341f	5 N	8 N	10 N	13 N	36 N	46 1/3	46 1/3	69 1/2
341g	10 N	17 N	16 N	28 N	39 N	56 1/2	59 1/2	73 1/2
342a	50 N	79 2/3	77 2/3	82 2/3	39 N	51 1/3	48 1/3	63 1/2
342b	50 N	74 2/3	69 1/2	79 2/3	42 N	52 1/3	59 1/2	69 1/2
342c	60 1/3	77 2/3	75 1/2	79 2/3	45 1/3	62 1/2	62 1/2	73 1/2
342d	45 N	48 1/3	52 1/3	44 N	51 1/3	62 1/2	62 1/2	69 1/2
342e	20 N	24 N	23 N	36 N	43 1/3	47 1/3	45 1/3	59 1/2

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
342f	5 N	12 N	11 N	16 N	39 N	49 1/3	46 1/3	62 1/2
342g	20 N	21 N	14 N	28 N	39 N	47 1/3	43 1/3	62 1/2
343a	30 N	53 1/3	66 1/2	66 1/2	30 N	33 N	29 N	39 N
343b	25 N	47 1/3	51 1/3	56 1/3	31 N	41 1/3	36 N	57 1/3
343c	15 N	41 1/3	39 N	54 1/3	28 N	35 N	27 N	50 1/3
343d	15 N	18 N	21 N	23 N	21 N	26 N	22 N	41 N
343e	10 N	13 N	16 N	23 N	28 N	33 N	24 N	47 1/3
343f	5 N	7 N	9 N	10 N	21 N	26 N	22 N	41 N
343g	10 N	12 N	9 N	21 N	20 N	27 N	21 N	38 N
344a	40 N	79 2/3	73 1/2	80 2/3	63 1/2	67 1/2	61 1/2	63 1/2
344b	35 N	76 2/3	68 1/2	77 1/2	78 2/3	78 2/3	71 1/2	80 2/3
344c	45 N	78 2/3	75 1/2	85 2/3	81 2/3	88 2/3	79 2/3	79 2/3
344d	35 N	52 1/3	50 1/3	40 N	82 2/3	88 2/3	76 2/3	79 2/3
344e	25 N	28 N	20 N	38 N	77 2/3	76 2/3	66 1/2	72 1/2
344f	10 N	17 N	10 N	13 N	83 2/3	79 2/3	65 1/2	76 2/3
344g	25 N	27 N	14 N	28 N	76 2/3	78 2/3	67 1/2	70 1/2
345a	40 N	54 1/3	57 1/3	44 N	49 1/3	41 1/3	36 N	44 1/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
345b	45 N	41 1/3	45 1/3	41 N	62 1/2	55 1/2	58 1/2	58 1/3
345c	50 N	63 1/2	74 1/2	51 1/3	68 1/2	75 2/3	76 2/3	78 2/3
345d	45 N	46 1/3	54 1/3	28 N	75 1/2	78 2/3	74 2/3	79 2/3
345e	20 N	22 N	22 N	23 N	68 1/2	65 1/2	59 1/2	69 1/2
345f	10 N	11 N	11 N	5 N	59 1/3	54 1/3	45 1/3	60 1/2
345g	15 N	19 N	14 N	20 N	60 1/2	64 1/2	53 1/3	63 1/2
346a	50 N	85 2/3	82 2/3	87 2/3	65 1/2	67 1/2	69 1/2	70 1/2
346b	40 N	55 1/3	45 1/3	59 1/3	55 1/3	57 1/2	55 1/3	62 1/2
346c	45 N	74 2/3	75 1/2	87 2/3	58 1/3	66 1/2	66 1/2	69 1/2
346d	30 N	56 1/3	51 1/3	51 1/3	57 1/3	69 1/2	71 1/2	71 1/2
346e	15 N	29 N	16 N	35 N	52 1/3	51 1/3	46 1/3	55 1/3
346f	5 N	14 N	9 N	13 N	51 1/3	49 1/3	43 1/3	54 1/3
346g	10 N	25 N	16 N	36 N	55 1/3	55 1/2	52 1/3	61 1/2
347a	55 1/3	88 2/3	84 2/3	85 2/3	65 1/2	69 1/2	72 1/2	70 1/2
347b	45 N	52 1/3	46 1/3	64 1/2	56 1/3	58 1/2	54 1/3	62 1/2
347c	50 N	76 2/3	82 2/3	87 2/3	59 1/3	68 1/2	69 1/2	71 1/2
347d	40 N	56 1/3	57 1/3	57 1/3	55 1/3	69 1/2	71 1/2	77 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
347e	25 N	29 N	22 N	38 N	48 1/3	50 1/3	47 1/3	57 1/3
347f	5 N	15 N	12 N	15 N	46 1/3	49 1/3	42 1/3	58 1/3
347g	20 N	25 N	16 N	34 N	51 1/3	53 1/3	54 1/3	63 1/2
348a	55 1/3	89 2/3	84 2/3	90 2/3	60 1/2	63 1/2	58 1/2	54 1/3
348b	50 N	79 2/3	78 2/3	84 2/3	63 1/2	63 1/2	62 1/2	58 1/3
348c	60 1/3	85 2/3	77 2/3	82 2/3	56 1/3	65 1/2	56 1/3	63 1/2
348d	40 N	50 1/3	43 N	43 N	49 1/3	57 1/2	51 1/3	58 1/3
348e	25 N	31 N	23 N	41 N	49 1/3	51 1/3	48 1/3	54 1/3
348f	10 N	13 N	11 N	18 N	52 1/3	49 1/3	43 1/3	55 1/3
348g	15 N	24 N	16 N	31 N	52 1/3	48 1/3	46 1/3	50 1/3
349a	30 N	73 2/3	74 1/2	80 2/3	74 1/2	71 2/3	66 1/2	65 1/2
349b	30 N	63 1/2	70 1/2	77 1/2	79 2/3	83 2/3	75 2/3	83 2/3
349c	30 N	71 1/2	75 1/2	82 2/3	75 1/2	87 2/3	81 2/3	85 2/3
349d	30 N	41 1/3	42 N	46 1/3	76 2/3	85 2/3	77 2/3	84 2/3
349e	25 N	26 N	21 N	38 N	80 2/3	85 2/3	77 2/3	84 2/3
349f	15 N	13 N	12 N	15 N	79 2/3	83 2/3	75 2/3	81 2/3
349g	20 N	22 N	14 N	31 N	77 2/3	80 2/3	69 1/2	76 2/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
350a	50 N	71 1/2	75 1/2	72 1/2	69 1/2	66 1/2	60 1/2	60 1/2
350b	55 1/3	51 1/3	45 1/3	61 1/3	81 2/3	76 2/3	71 1/2	78 2/3
350c	55 1/3	72 1/2	74 1/2	72 1/2	84 2/3	84 2/3	77 2/3	80 2/3
350d	55 1/3	52 1/3	58 1/3	46 1/3	85 2/3	85 2/3	79 2/3	84 2/3
350e	30 N	33 N	18 N	40 N	82 2/3	83 2/3	77 2/3	82 2/3
350f	15 N	17 N	12 N	15 N	80 2/3	79 2/3	65 1/2	79 2/3
350g	25 N	26 N	14 N	28 N	80 2/3	85 2/3	80 2/3	81 2/3
351a	15 N	56 1/3	54 1/3	47 1/3	30 N	46 1/3	44 1/3	54 1/3
351b	15 N	44 1/3	44 1/3	54 1/3	39 N	56 1/2	56 1/3	68 1/2
351c	15 N	52 1/3	54 1/3	47 1/3	40 N	61 1/2	55 1/3	69 1/2
351d	15 N	33 N	32 N	28 N	38 N	61 1/2	56 1/3	69 1/2
351e	10 N	22 N	16 N	23 N	38 N	60 1/2	61 1/2	70 1/2
351f	10 N	13 N	10 N	10 N	38 N	62 1/2	58 1/2	71 1/2
351g	5 N	22 N	12 N	23 N	34 N	64 1/2	60 1/2	70 1/2
352a	15 N	50 1/3	55 1/3	56 1/3	31 N	39 1/3	38 N	40 N
352b	15 N	43 1/3	49 1/3	56 1/3	37 N	41 1/3	39 N	44 1/3
352c	15 N	41 1/3	55 1/3	54 1/3	33 N	42 1/3	37 N	43 1/3

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
352d	15 N	16 N	22 N	30 N	26 N	30 N	23 N	35 N
352e	15 N	16 N	14 N	30 N	28 N	35 N	29 N	32 N
352f	10 N	7 N	9 N	10 N	26 N	28 N	21 N	31 N
352g	15 N	15 N	10 N	20 N	24 N	27 N	22 N	27 N
353a	30 N	61 1/2	57 1/3	76 1/2	25 N	38 1/3	30 N	46 1/3
353b	30 N	37 N	37 N	57 1/3	26 N	31 N	34 N	45 1/3
353c	25 N	46 1/3	46 1/3	57 1/3	24 N	38 1/3	35 N	55 1/3
353d	25 N	26 N	34 N	36 N	24 N	41 1/3	38 N	61 1/2
353e	10 N	17 N	15 N	25 N	21 N	29 N	25 N	43 1/3
353f	0 N	10 N	13 N	10 N	28 N	34 N	26 N	49 1/3
353g	15 N	16 N	16 N	25 N	25 N	34 N	29 N	45 1/3
354a	20 N	27 N	20 N	20 N	34 N	42 1/3	30 N	38 N
354b	20 N	24 N	15 N	18 N	46 1/3	54 1/3	42 1/3	50 1/3
354c	20 N	29 N	22 N	26 N	57 1/3	55 1/2	40 1/3	51 1/3
354d	20 N	17 N	13 N	13 N	52 1/3	54 1/3	38 N	52 1/3
354e	10 N	13 N	7 N	10 N	58 1/3	59 1/2	44 1/3	53 1/3
354f	15 N	12 N	9 N	8 N	60 1/2	64 1/2	49 1/3	59 1/2

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
354g	15 N	10 N	8 N	10 N	53 1/3	52 1/3	41 1/3	50 1/3
355a	35 N	63 1/2	56 1/3	64 1/2	37 N	45 1/3	44 1/3	49 1/3
355b	35 N	58 1/2	59 1/3	59 1/3	46 1/3	50 1/3	53 1/3	53 1/3
355c	35 N	53 1/3	45 1/3	49 1/3	42 N	44 1/3	48 1/3	50 1/3
355d	30 N	25 N	23 N	18 N	32 N	34 N	39 N	47 1/3
355e	10 N	18 N	12 N	15 N	35 N	32 N	35 N	43 1/3
355f	10 N	10 N	8 N	10 N	31 N	30 N	32 N	32 N
355g	10 N	14 N	8 N	15 N	26 N	30 N	35 N	35 N
356a	10 N	18 N	10 N	10 N	35 N	36 N	36 N	36 N
356b	10 N	18 N	12 N	10 N	40 N	50 1/3	51 1/3	50 1/3
356c	15 N	18 N	15 N	8 N	43 1/3	48 1/3	48 1/3	51 1/3
356d	10 N	12 N	6 N	6 N	46 1/3	48 1/3	45 1/3	46 1/3
356e	15 N	9 N	4 N	3 N	42 N	53 1/3	10 N	8 N
356f	15 N	9 N	10 N	8 N	62 1/2	70 1/2	71 1/2	63 1/2
356g	15 N	5 N	2 N	3 N	36 N	55 1/2	47 1/3	50 1/3
357a	N	N	N	N	N	N	N	N
357b	N	N	N	N	N	N	N	N

TASK/ACTIVITY NUMBER	INDUSTRIAL HYGIENE LEVEL OF ASSIGNMENT				SAFETY PROFESSIONAL LEVEL OF ASSIGNMENT			
	1	2	3	4	1	2	3	4
357c	N	N	N	N	N	N	N	N
357d	N	N	N	N	N	N	N	N
357e	N	N	N	N	N	N	N	N
357f	N	N	N	N	N	N	N	N
357g	N	N	N	N	N	N	N	N

APPENDIX V

Course Outlines
for
Industrial Hygiene
Baccalaureate Curriculum

COURSE OUTLINE

COURSE TITLE: INTRODUCTION TO INDUSTRIAL PROCESSES

REF. IH-1

SEMESTER HOURS:
Theory 2
Laboratory 3

Credit Hours 3

TOTAL HOURS:
Theory and Lab
75

PREREQUISITES:
Chemistry, first semester of Physics, Mathematics through the first semester, Other courses within a specified curriculum as required.

BRIEF DESCRIPTION:
An introduction to the technology of industry, with emphasis on describing various general industrial operations and processes. Process steps involved and potential hazards which are introduced are also discussed. Process flow sheets, layouts, descriptions, slides, and guest speakers can be utilized. Laboratory sessions are scheduled for field trips or guest speakers representing various industries.

TOPIC OUTLINE:	HOURS	
	THEORY	LAB
Review of Manufacturing and Commercial Categories	3	
Basic Metals	3	6
Metal Fabrication and Processes	2	3
Wood Products and Processes	2	3
Agriculture and Food Processing	2	3
Textiles and Clothing Manufacturing	2	3
The Chemical Industry--Processes and Products	2	6
Glass and Plastic Industries	2	3
Pulp and Paper--Processes and Products	2	3
Rubber Products and Processes	2	3
Paint Manufacturing	2	3
Mining--Underground and Surface	2	3
Construction	2	3
Transportation	2	3
	30	45

COURSE OUTLINE

COURSE TITLE: INTRODUCTION TO OCCUPATIONAL HEALTH AND SAFETY

REF. IH-2

SEMESTER HOURS:
Theory 3
Laboratory ____

Credit Hours 3

TOTAL HOURS:
Theory and Lab
45

PREREQUISITES:
Chemistry, Mathematics

BRIEF DESCRIPTION:

An introduction to occupational health and safety including historical developments, occupational health and safety program concepts, social and legislative requirements, professional relationships, and a general introduction to concepts of recognition, evaluation, and control of exposures.

TOPIC OUTLINE:	HOURS THEORY	LAB
Historical Perspectives	2	-
Loss Control Programs	3	-
Occupational Health and Safety Programs	3	-
Product Safety and Consumer Protection Programs	2	-
Legislative Activity, 1900-1977	6	-
Management/Employee/Occupational Health and Safety Specialist Relationships	3	-
Relationship with Enforcement Personnel-Federal, State, Local	3	-
Introduction to Recognition, Evaluation, and Control of Exposures	5	-
Recognition of Exposures (cognition, study of historical data, knowledge of operations, etc.)	6	-
Analysis, Evaluation, Control of Exposures	12	
	45	

COURSE OUTLINE

COURSE TITLE: GENERAL CONCEPTS IN OCCUPATIONAL HEALTH AND SAFETY	REF. IH-3

SEMESTER HOURS:

Theory 2

Laboratory

Credit Hours 2

TOTAL HOURS:

Theory and Lab 30

PREREQUISITES:

Chemistry, Mathematics, Communications, IH-1, IH-2

BRIEF DESCRIPTION:

The application of prerequisite information to occupational health and safety, health and safety programs, application of knowledge in developing a well-rounded injury/illness prevention program, general concepts of supervisory/employee input, associations with regulatory agencies and other organizations.

TOPIC OUTLINE:	HOURS THEORY	HOURS LAB
Planning the Occupational Health & Safety Program	6	-
Budget Preparation	2	-
Employee Committees	3	-
Interface with Production Supervision	4	-
Medical Relationships and Biological Exposures	3	-
Interface with Purchasing Department	3	-
Interface with Maintenance Department	3	-
Interface with Regulatory Agencies	3	-
Interface with Other Organizations	3	-
	30	

COURSE OUTLINE

COURSE TITLE: FIELD INSTRUMENTATION	REF. IH-4

SEMESTER HOURS:
Theory 2
Laboratory 3

Credit Hours 3

TOTAL HOURS:
Theory and Lab
45

PREREQUISITES:
Organic Chemistry, Physics, Mathematics, Human Physiology, IH-1, IH-2, IH-3

BRIEF DESCRIPTION:
Lectures and laboratories to introduce field sampling instruments, concepts, quality control, and statistical analysis. Considerable emphasis given to instrument selection and calibration. Knowledge of instruments, including capability and inability, sampling locations, maintenance of sample integrity are stressed. Course is performance based.

TOPIC OUTLINE:	HOURS THEORY	 LAB
The Requirement for Air Quality Sampling	2	
Quality Control Concepts	2	3
Qualitative and Quantitative Interpretations	2	-
Direct Reading Field Instruments	6	9
Calibration of Direct Reading Field Instruments	3	6
Field Sampling for Laboratory Analysis	6	9
Calibration of Field Sampling Systems	3	6
Interpretation of Data	3	9
Reporting of Data	3	3
	30	45

COURSE OUTLINE

COURSE TITLE: LABORATORY INSTRUMENTATION AND ANALYSIS

REF. IH-5

SEMESTER HOURS:
Theory 2
Laboratory 3

Credit Hours 3

TOTAL HOURS:
Theory and Lab 75

PREREQUISITES:
Organic Chemistry, Physics, Mathematics, Human Physiology, Statistics, IH-1, IH-2, IH-3, IH-4

BRIEF DESCRIPTION:
Lectures and laboratories designed to teach the student laboratory instrumentation and analysis methods common to Industrial Hygiene. Student is required to analyze samples from the field using various methods, and to prepare lab reports. Course is performance based.

TOPIC OUTLINE:	HOURS THEORY	HOURS LAB
Introduction to Laboratory Instrumentation	3	3
Quality Control Concepts	2	3
Qualitative and Quantitative Interpretations	3	3
Calibration of Sampling and Analysis Systems	2	3
Gravimetric Methods of Analysis	2	3
Volumetric Methods of Analysis	2	3
Gas Chromatography	6	15
Infrared Spectroscopy	3	3
Mass Spectroscopy	4	6
Atomic Absorption Spectrophotometry	3	3
	30	45

COURSE OUTLINE

COURSE TITLE: AIR QUALITY FOR INDUSTRIAL HYGIENE

REF. IH-6

SEMESTER HOURS:
Theory 2
Laboratory 3

Credit Hours 3

TOTAL HOURS:
Theory and Lab
75

PREREQUISITES:
Organic Chemistry, Physics, Mathematics, Human Physiology, Statistics, Communications, IH-1, IH-2, IH-3, IH-4, IH-5

BRIEF DESCRIPTION:
This course builds on the information previously acquired in field instrumentation and lab instrumentation. The student is required to recognize a potential exposure, to develop the sampling method and system, to calibrate the sampling system, to collect and analyze samples, and to develop control methods. Technical reports are required.

TOPIC OUTLINE:	HOURS	
	THEORY	LAB
Standards, Codes, Regulations	2	-
Air Quality Sampling Systems	3	6
Selection of Sampling Methods	3	3
Completing The Air Quality Survey	3	6
Evaluation of Air Quality Data	6	3
Environmental Controls for Exposures	3	9
Engineering Controls for Exposures	4	9
Operational Controls for Exposures	3	6
Personal Protective Equipment for Control of Exposures	3	3
	30	45

COURSE OUTLINE

COURSE TITLE: PHYSICAL EXPOSURES FOR INDUSTRIAL HYGIENE

REF. IH-7

SEMESTER HOURS:

Theory 2

Laboratory 3

Credit Hours 3

TOTAL HOURS:

Theory and Lab

75

PREREQUISITES:

Organic Chemistry, Physics, Mathematics, Human Physiology, Statistics, Communications, IH-1, IH-2, IH-3, IH-4, IH-5

BRIEF DESCRIPTION:

Lecture and laboratory exercises in physical exposures (radiation, thermal stress, abnormal pressures, etc.). The student is required to recognize potential exposures, use correct instrumentation, collect and evaluate data, and develop controls. Technical reports are required. Course is performance based.

TOPIC OUTLINE:	HOURS THEORY	 LAB
Physics Review	2	-
Regulations, Codes, Standards	1	-
Ionizing Radiation	5	-
Instrumentation for Ionizing Radiation	3	6
Non-Ionizing Radiation	2	-
Instrumentation for Non-Ionizing Radiation	2	3
Evaluation of Radiation Exposures	2	6
Thermal Exposures	2	-
Recognition and Evaluation of Thermal Exposures	2	3
Abnormal Pressure and the Work Environment	2	-
Control of Exposures to Physical Agents	7	
- Ionizing Radiation		12
- Non-Ionizing Radiation		6
- Temperature Extremes		6
- Abnormal Pressures		3
	30	45

COURSE OUTLINE

COURSE TITLE: NOISE EVALUATION AND CONTROL

REF. IH-8

SEMESTER HOURS:
Theory 2
Laboratory 3

Credit Hours 3

TOTAL HOURS:
Theory and Lab
75

PREREQUISITES:
Chemistry, Physics, Human Physiology, Mathematics, Statistics, Communications, IH-1, IH-2, IH-3, IH-7

BRIEF DESCRIPTION:
Emphasis is on noise evaluation and various control methods. Physiological and physical aspects are stressed. Student is required to demonstrate knowledge of instrumentation, data acquisition, data analysis, and control of exposures. Design capability is expected. The course is performance based. Technical reports are required.

TOPIC OUTLINE:	HOURS THEORY	LAB
Standards, Codes, Regulations	1	-
Physiological Aspects of Noise	2	-
Physical Aspects of Noise	2	-
Subjective Aspects of Noise	1	-
Medical and Legal Aspects	2	-
Measured Characteristics of Noise	2	-
Noise Measurement Instrumentation	3	6
Noise Surveys	3	9
Interpretation of Noise Data	2	6
Environmental Controls for Exposures	2	6
Engineering Controls for Exposures	3	9
Operational Controls for Exposures	3	6
Personal Protective Equipment	2	3
Hearing Conservation Programs	2	-
	30	45

COURSE OUTLINE

COURSE TITLE: HAZARDOUS MATERIALS FOR INDUSTRIAL HYGIENE

REF. IH-9

SEMESTER HOURS:

Theory 3

Credit Hours 3

Laboratory

TOTAL HOURS:
Theory and Lab
45

PREREQUISITES:

Organic Chemistry, Physics, Mathematics, Statistics, Human Physiology, Communications, IH-1, IH-2, IH-3, IH-4

BRIEF DESCRIPTION:

Emphasis is placed on liquid and solid substances excluding air contaminants. Lectures include recognition, evaluation and control methods. Student is required to develop control methods and present them in technical reports.

TOPIC OUTLINE:	HOURS THEORY	HOURS LAB
Introduction to Hazardous Materials	6	-
Specifications, Standards, Codes, Regulations	4	-
Recognition and Evaluation of Exposures	10	-
Engineering Controls for Exposures	5	-
Operational Controls for Exposures	5	-
Education/Training Controls	4	-
Personal Protective Clothing and Equipment	3	-
Consumer Protection/Product Safety	3	-
	5	-
	45	

COURSE OUTLINE

COURSE TITLE: FLAMMABLE MATERIALS FOR INDUSTRIAL HYGIENE

REF. IH-10

SEMESTER HOURS:
Theory 3
Laboratory
Credit Hours 3

TOTAL HOURS:
Theory and Lab
45

PREREQUISITES:

Organic Chemistry, Physics, Mathematics, Statistics, Human Physiology, Communications, IH-1, IH-2, IH-3, IH-4, IH-6

BRIEF DESCRIPTION:

Lectures on gases, vapors, dusts, liquids and solids and their physical and chemical characteristics; flammables, fire retardants, and fire resistant materials. Emphasis is on sampling, evaluation and control methods. Design of fire-resistant facilities is considered. Technical reports are required, including design requirements as specified by regulatory agencies.

TOPIC OUTLINE:	HOURS	
	THEORY	LAB
Liquids, Vapors, Gases	3	-
Dusts and Solid Materials	3	-
Standards, Codes, Regulations	5	-
Instrumentation	3	-
Analysis and Evaluation	4	-
Fire Protection Equipment	4	-
Engineering Controls for Exposures	6	-
Environmental Controls for Exposures	6	-
Operational Controls for Exposures	6	-
Education/Training Controls	3	-
Personal Protective Equipment and Clothing	2	-
	45	

COURSE OUTLINE

COURSE TITLE: MATERIALS HANDLING FOR INDUSTRIAL HYGIENE

REF. IH-11

SEMESTER HOURS:
Theory 3
Laboratory
Credit Hours 3

TOTAL HOURS:
Theory and Lab
45

PREREQUISITES:

Chemistry, Physics, Mathematics, Human Physiology, Statistics, Communications, Human Factors, IH-1, IH-2, IH-3, IH-6, IH-7, IH-9, IH-10

BRIEF DESCRIPTION:

Lectures with emphasis on the recognition, evaluation and control of both manual methods of handling material and mechanical methods. Ergonomics is stressed. Student is provided case histories and is required to study these and develop technical reports.

TOPIC OUTLINE:

	HOURS	
	THEORY	LAB
Specifications, Standards, Codes, Regulations	2	-
Principles of Ergonomics	9	-
Manual Material Handling Exposures	5	-
Mechanical Material Handling Exposures	3	-
Employee Selection and Placement	3	
Fixed and Mobile Mechanical Systems	3	-
Recognition and Evaluation of Exposures	5	-
Environmental Controls for Exposures	6	-
Engineering Controls for Exposures	4	-
Operational Controls for Exposures	3	-
Education/Training Controls	2	-
	45	

COURSE OUTLINE

COURSE TITLE: EDUCATION/TRAINING METHODS FOR INDUSTRIAL HYGIENE

REF. IH-12

SEMESTER HOURS:

Theory 2

Laboratory 0

Credit Hours 2

TOTAL HOURS:

Theory and Lab 30

PREREQUISITES:

Chemistry, Physics, Mathematics, Statistics, Human Physiology, Communications, IH-1, IH-2, IH-3, IH-4, IH-5, IH-6, IH-7, IH-8, IH-9, IH-10, IH-11

BRIEF DESCRIPTION:

Lectures with emphasis on education/training for the control or prevention of job-related injuries, illnesses, or disease. Education/training methods, materials, and available courses are stressed. Student is expected to analyze the need for education/training programs, and establish criteria for selection and evaluation of the programs.

TOPIC OUTLINE:	HOURS THEORY	LABS
Education/Training Concepts in Occupational Health & Safety	2	
Education/Training as a Control for Injuries/Illnesses	5	
Education/Training Methods		
- Classroom	1	
- On the job	2	
- Programmed Learning	1	
Education/Training Techniques		
- Indoctrination	2	
- Visual Aids	2	
- Testing and Evaluation	2	
Development and Need-Based Education/Training	10	
Re-Training Programs	2	
	30	

COURSE OUTLINE

COURSE TITLE: EVALUATION AND CONTROL METHODS IN OCCUPATIONAL HEALTH AND SAFETY (INDUSTRIAL HYGIENE)

REF. IH-13

SEMESTER HOURS:
Theory 2
Laboratory 3

Credit Hours 3

TOTAL HOURS:
Theory and Lab
75

PREREQUISITES:

Chemistry, Physics, Mathematics, Human Physiology, Statistics, Communications, all Industrial Hygiene courses through IH-12

BRIEF DESCRIPTION:

The development of formal technical reports by groups of students functioning as a team to evaluate specific operations, methods, environments, equipment, etc. and to determine significantly important exposures, develop controls, and justify the controls. Course is performance based.

TOPIC OUTLINE:	HOURS	
	THEORY	LAB
Evaluation and Control Methods	2	-
Preparing the Written Report for Management	2	-
Evaluation--The Walk Through Survey	2	6
Evaluation--Study of Specific Operations	3	6
Evaluation--Study of Past Experience	2	3
Evaluation--Study of Procedures, Methods, Practices	3	6
Evaluation--Study of Facility Plans, Specifications, etc.	2	3
Evaluation--Product Design, Specifications, Data Sheets	2	3
Control--Design of Facilities	2	3
Control--Material Storage (raw material, material in-processing, etc.	2	3
Control--Design of Production Systems (layout, etc.)	2	3
Control--Housekeeping methods	2	3
Control--Labeling and Directions	2	3
Control--Maintenance Procedures and Schedules	2	3
	30	45

COURSE OUTLINE

COURSE TITLE: MANAGEMENT TECHNIQUES IN OCCUPATIONAL HEALTH AND SAFETY (INDUSTRIAL HYGIENE)

REF. IH-14

SEMESTER HOURS:
Theory 3
Laboratory
Credit Hours 3

TOTAL HOURS:
Theory and Lab 45

PREREQUISITES:

Chemistry, Physics, Mathematics, Human Physiology, Statistics, Communications, approved courses in management and economics, all Industrial Hygiene courses through IH-10

BRIEF DESCRIPTION:

Management techniques applied to occupational health and safety, direction of programs, selection, supervision and evaluation of technical personnel, establishing objectives and priorities, intra-company relations, securing quality performance. Technical reports required.

TOPIC OUTLINE:	HOURS	
	THEORY	LAB
Management Concepts Applied to Occupational Health & Safety	2	-
The Occupational Health and Safety Program	3	-
The Industrial Hygienist as a Manager	2	-
Quantitative Concepts in Management	5	-
Decision Making and Establishing Objectives	5	-
Direction of Occupational Health and Safety Program	3	-
Relationships with Medical Personnel	4	-
Relationships with Production Engineering Personnel	4	-
Relationships with Product Designers	2	-
Relationships with Safety Professionals	2	-
Relationships with Regulatory Agencies	4	-
Project Control--Long Term and Short Term	3	-
Company Cost Control and Budgeting	4	-
Managing a Dynamic Occupational Health & Safety Program	2	-
	45	

APPENDIX VI

Course Outlines
for
Safety Professional
Baccalaureate Curriculum

COURSE OUTLINE

COURSE TITLE: INTRODUCTION TO INDUSTRIAL PROCESSES

REF. SP-1

SEMESTER HOURS:
Theory 2
Laboratory 3

Credit Hours 3

TOTAL HOURS:
Theory and Lab
75

PREREQUISITES:

Chemistry, first semester of Physics, Mathematics through the first semester, Other courses within a specified curriculum as required.

BRIEF DESCRIPTION:

An introduction to the technology of industry, with emphasis on describing various general industrial operations and processes. Process steps involved and potential hazards which are introduced are also discussed. Process flow sheets, layouts, descriptions, slides, and guest speakers can be utilized. Laboratory sessions are scheduled for field trips or guest speakers representing various industries.

TOPIC OUTLINE:	HOURS THEORY	HOURS LAB
Review of Manufacturing and Commercial Categories	3	
Basic Metals	3	6
Metal Fabrication and Processes	2	3
Wood Products and Processes	2	3
Agriculture and Food Processing	2	3
Textiles and Clothing Manufacturing	2	3
The Chemical Industry--Processes and Products	2	6
Glass and Plastic Industries	2	3
Pulp and Paper--Processes and Products	2	3
Rubber Products and Processes	2	3
Paint Manufacturing	2	3
Mining--Underground and Surface	2	3
Construction	2	3
Transportation	2	3
	30	45

COURSE OUTLINE

COURSE TITLE: INTRODUCTION TO OCCUPATIONAL HEALTH AND SAFETY

REF. SP-2

SEMESTER HOURS:
Theory 3
Laboratory

Credit Hours 3

TOTAL HOURS:
Theory and Lab
45

PREREQUISITES:
Chemistry, Mathematics

BRIEF DESCRIPTION:
An introduction to occupational health and safety including historical developments, occupational health and safety program concepts, social and legislative requirements, professional relationships, and a general introduction to concepts of recognition, evaluation, and control of exposures.

TOPIC OUTLINE:

	HOURS	
	THEORY	LAB
Historical Perspectives	2	-
Loss Control Programs	3	-
Occupational Health and Safety Programs	3	-
Product Safety and Consumer Protection Programs	2	-
Legislative Activity, 1900-1977	6	-
Management/Employee/Occupational Health and Safety Specialist Relationships	3	-
Relationship with Enforcement Personnel-Federal, State, Local	3	-
Introduction to Recognition, Evaluation, and Control of Exposures	5	-
Recognition of Exposures (cognition, study of historical data, knowledge of operations, etc.)	6	-
Analysis, Evaluation, Control of Exposures	12	
	45	

COURSE OUTLINE

COURSE TITLE: GENERAL CONCEPTS IN OCCUPATIONAL HEALTH AND SAFETY

REF. SP-3

SEMESTER HOURS:
Theory 2
Laboratory ____

Credit Hours 2

TOTAL HOURS:
Theory and Lab
30

PREREQUISITES:
Chemistry, Mathematics, Communications, SP-1, SP-2

BRIEF DESCRIPTION:
The application of prerequisite information to occupational health and safety, health and safety programs, application of knowledge in developing a well-rounded injury/illness prevention program, general concepts of supervisory/employee input, associations with regulatory agencies and other organizations.

TOPIC OUTLINE:	HOURS THEORY	LAB
Planning the Occupational Health & Safety Program	6	-
Budget Preparation	2	-
Employee Committees	3	-
Interface with Production Supervision	4	-
Medical Relationships and Biological Exposures	3	-
Interface with Purchasing Department	3	-
Interface with Maintenance Department	3	-
Interface with Regulatory Agencies	3	-
Interface with Other Organizations	3	
	30	

COURSE OUTLINE

COURSE TITLE: AIR QUALITY FOR THE SAFETY PROFESSIONAL

REF. SP-4

SEMESTER HOURS:
Theory 2
Laboratory 3

Credit Hours 3

TOTAL HOURS:
Theory and Lab
75

PREREQUISITES:
Organic Chemistry, Physics, Mathematics, Human Physiology, Communications, SP-1, SP-2, SP-3

BRIEF DESCRIPTION:
A study of chemical agents (gases, vapors, dusts, mist, etc.) and related exposures, physiological effects on the human organism, and the recognition, evaluation and control of the exposures in industry. Emphasis is on both theory and performance-related practice. Technical reports are required.

TOPIC OUTLINE:

	HOURS	
	THEORY	LAB
Chemistry Review	2	3
Physics Review	2	-
Physiology Review	2	-
Toxicology	3	-
Standards, Codes, Regulations	2	-
Field Instrumentation	4	9
Field Instrumentation Calibration	2	6
Sampling	2	9
Analysis and Evaluation	2	6
Environmental Controls for Exposures	3	3
Engineering Controls for Exposures	3	6
Operational Controls for Exposures	3	3
	30	45

COURSE OUTLINE

COURSE TITLE: PHYSICAL EXPOSURES FOR THE SAFETY PROFESSIONAL

REF. SP-5

SEMESTER HOURS:
Theory 2
Laboratory 3

Credit Hours 3

TOTAL HOURS:
Theory and Lab
75

PREREQUISITES:
Organic Chemistry, Physics, Mathematics, Human Physiology, Statistics, Communications, SP-1, SP-2, SP-3, SP-4

BRIEF DESCRIPTION:
Lecture and laboratory exercises for the recognition, evaluation and control of physical exposures (noise, vibration, radiation, thermal stress, etc.). The student is required to recognize potential exposures, to use correct instrumentation, collect and evaluate data, and develop controls. Technical reports are required. Course is performance based.

TOPIC OUTLINE:	HOURS	
	THEORY	LAB
Physics Review	2	-
Sound and Noise	2	-
Instrumentation for Noise Measurement	2	3
Noise, Measurement and Evaluation	2	6
Hearing Conservation Programs	1	-
Ionizing Radiation	3	-
Instrumentation for Radiation	1	3
Evaluation of Radiation Exposures	2	3
Evaluation of Thermal Exposures	1	3
Evaluation of Abnormal Pressure Exposures	2	-
Control of Exposures to Physical Agents	12	27
	30	45

COURSE OUTLINE

COURSE TITLE: HAZARDOUS MATERIALS FOR THE SAFETY PROFESSIONAL	REF. SP-6

SEMESTER HOURS:
Theory 3
Laboratory ______
Credit Hours 3

TOTAL HOURS:
Theory and Lab
45

PREREQUISITES:
Organic Chemistry, Physics, Mathematics, Human Physiology, Statistics, Communications, SP-1, SP-2, SP-3, SP-4,

BRIEF DESCRIPTION:
Emphasis is given to liquid and solid substances excluding air contaminants. Lectures include recognition, evaluation and control of exposures. Given defined exposures, student is required to develop control methods and present them in technical reports.

TOPIC OUTLINE:	HOURS THEORY	LABS
Introduction to Hazardous Materials	6	-
Specifications, Standards, Codes, Regulations	4	-
Instrumentation for Hazardous Materials	4	-
Evaluation of Exposures to Hazardous Materials	6	-
Environmental Controls for Exposures	3	-
Engineering Controls for Exposures	7	-
Operational Controls for Exposures	4	-
Education/Training Controls	3	
Personal Protective Clothing and Equipment	3	
Product Safety	5	
	45	

COURSE OUTLINE

COURSE TITLE: FLAMMABLE MATERIALS FOR THE SAFETY PROFESSIONAL

REF. SP-7

SEMESTER HOURS:

Theory 3

Laboratory

Credit Hours 3

TOTAL HOURS:

Theory and Lab

45

PREREQUISITES:

Organic Chemistry, Physics, Mathematics, Human Physiology, Statistics, Communications, SP-1, SP-2, SP-3, SP-4, SP-5, SP-6

BRIEF DESCRIPTION:

Lectures on gases, vapors, dusts, liquids and solids and their physical and chemical characteristics; flammables, fire retardants, and fire resistant materials. Emphasis is on environmental sampling, evaluation and control methods. Technical reports are required, including fire protection design criteria as specified in building codes and by regulatory agencies.

TOPIC OUTLINE:

	HOURS	
	THEORY	LABS
Liquids, Vapors, Gases	3	-
Dusts and Solid Materials	3	-
Standards, Codes, Regulations	5	-
Instrumentation	3	-
Analysis and Evaluation	4	-
Fire Protection Equipment	4	-
Environmental Controls for Exposures	3	-
Engineering Controls for Exposures	9	-
Operational Control of Exposures	6	-
Education/Training Controls	3	
Personal Protective Equipment and Clothing	2	
	45	

COURSE OUTLINE

COURSE TITLE: MATERIALS HANDLING FOR THE SAFETY PROFESSIONAL	REF. SP-8

SEMESTER HOURS:
Theory 3
Laboratory
Credit Hours 3
TOTAL HOURS:
Theory and Lab
45

PREREQUISITES:
Chemistry, Physics, Mathematics, Human Physiology, Statistics, SP-1, SP-2, SP-3, SP-4, SP-5, SP-6, SP-7, Human Factors

BRIEF DESCRIPTION:
Lectures with emphasis on the recognition, evaluation and control of material handling exposures. Design of material handling system, operational analyses, the man-machine-environment relationship in a material handling system and ergonomics are stressed. Case histories are provided and the student is required to write technical reports specifying applicable control methods for assigned case histories.

TOPIC OUTLINE:	HOURS	
	THEORY	LABS
Standard, Codes, Regulations	3	-
Physiology and Biomechanics	6	-
Manual Material Handling Exposures	4	-
Mechanical Material Handling Exposures	6	-
Fixed Mechanical Systems	3	-
Mobile Mechanical Systems	3	-
Evaluation of Exposures	3	-
Environmental Controls	2	-
Engineering Controls for Exposures	8	-
Operational Controls for Exposures	4	-
Education/Training Controls	3	-
	45	

COURSE OUTLINE

COURSE TITLE: MECHANICAL AND ELECTRICAL FOR THE SAFETY PROFESSIONAL

REF. SP-9

SEMESTER HOURS:

Theory 3

Laboratory ______

Credit Hours 3

TOTAL HOURS:

Theory and Lab 45

PREREQUISITES:

Chemistry, Physics, Mathematics, Human Physiology, SP-1, SP-2, SP-3, SP-6,

BRIEF DESCRIPTION:

Study of mechanical/electrical systems other than mechanical material handling equipment; mechanical and electrical portable equipment; identification of exposures through system analysis techniques; evaluation of exposures; and the development of control procedures. Technical reports required.

TOPIC OUTLINE:

	HOURS	
	THEORY	LAB
Standards, Codes, Regulations	3	-
Identification of Exposures	4	-
Evaluation of Exposures	5	-
Portable Equipment	4	-
Machine Tools	8	-
Environmental Controls	3	-
Engineering Controls	10	-
Operational Controls	4	
Education/Training Controls	4	
	45	

COURSE OUTLINE

COURSE TITLE: FACILITIES FOR THE SAFETY PROFESSIONAL	REF. SP-10

SEMESTER HOURS:
Theory 3
Laboratory ______
Credit Hours 3

TOTAL HOURS:
Theory and Lab
45

PREREQUISITES:
Chemistry, Physics, Mathematics, Human Physiology, SP-1, SP-2, SP-3, SP-4, SP-5, SP-6, SP-7, SP-8, SP-9

BRIEF DESCRIPTION:
Lectures and case studies buildings (primarily manufacturing plants) and related services and facilities; gas, electricity, water, waste disposal, etc. Emphasis placed on fixed service facilities in the manufacturing operation; lighting, heating and cooling, steam generation, electrical distribution, lighting, etc. Technical reports required.

TOPIC OUTLINE:

	HOURS	
	THEORY	LAB
Building Codes and Other Standards	3	-
Building Construction and Materials	6	-
Building Maintenance and Modifications	4	-
Fire Resistance of Materials	3	-
Fire Protection Engineering	3	-
Fire Protection Systems	3	-
Utilities (Gas, Electricity, Water, etc.)	4	-
Steam Generation and Distribution	3	-
Industrial Gases	3	-
Illumination--Building and Grounds	2	-
Heating and Cooling	2	-
Warehousing and Storage	4	-
In-Plant Rail and Truck Facilities	2	-
Disposal of Waste Materials	3	-
	45	

COURSE OUTLINE

COURSE TITLE: EDUCATION/TRAINING METHODS FOR THE SAFETY PROFESSIONAL

REF. SP-11

SEMESTER HOURS:
Theory 2
Laboratory -

Credit Hours 2

TOTAL HOURS:
Theory and Lab
30

PREREQUISITES:
Chemistry, Physics, Mathematics, Human Physiology, Statistics, Communications, All Safety Professional courses through SP-7

BRIEF DESCRIPTION:
Lectures with emphasis on education/training for the control or prevention of occupational injuries or illnesses. Education/training methods, materials, and available courses are stressed. Student is expected to determine the need for education/training, design a program for a specific control effort, establish criteria for evaluation of the program.

TOPIC OUTLINE:

	HOURS	
	THEORY	LAB
Education/Training Concepts in Occupational Health & Safety	2	
Education/Training as a Control for Injuries/Illnesses	5	-
Education/Training Methods		
- Classroom	1	
- On the Job	2	
- Programmed Learning	1	
- Colleges, Universities, etc.	1	
Education/Training Techniques		
- Indoctrination	2	
- Visual Aids	2	
- Testing and Evaluation	2	
Development of Need-Based Education/Training	10	
Re-Training Programs	2	
	30	

COURSE OUTLINE

COURSE TITLE: EVALUATION AND CONTROL METHODS IN OCCUPATIONAL HEALTH AND SAFETY FOR THE SAFETY PROFESSIONAL

REF. SP-12

SEMESTER HOURS:
Theory 2
Laboratory 3

Credit Hours 3

TOTAL HOURS:
Theory and Lab
75

PREREQUISITES:
Organic Chemistry, Physics, Mathematics, Statistics, Human Physiology, Communications, All Safety Professional courses through SP-10

BRIEF DESCRIPTION:
The development of formal technical reports by groups of students functioning as a team to evaluate specific operations, methods, environments, equipment, etc. and to determine significantly important exposures, develop controls, and justify the controls. Course is performance based.

TOPIC OUTLINE:	HOURS	
	THEORY	LAB
Evaluation and Control Methods		
Quantitative Analyses (Fault Tree, Failure Mode & Effect, etc.		
Preparing the Written Report for Management		
Evaluation--The Walk Through Survey	2	6
Evaluation--Study of Specific Operations	3	6
Evaluation--Study of Past Experience	2	3
Evaluation--Study of Procedures, Methods, Practices	3	6
Evaluation--Study of Facility Plans, Specifications, etc.	2	3
Evaluation--Product Design, Specifications, Data Sheets	2	3
Control--Design of Facilities	2	3
Control--Material Storage (raw material, material in-processing, etc.	2	3
Control--Design of Production Systems (layouts, etc.)	6	9
Control--Housekeeping Methods	2	3
	30	45

COURSE OUTLINE

COURSE TITLE: MANAGEMENT TECHNIQUES IN OCCUPATIONAL HEALTH AND SAFETY FOR THE SAFETY PROFESSIONAL	REF. SP-13

SEMESTER HOURS:
Theory 3
Laboratory
Credit Hours 3
TOTAL HOURS:
Theory and Lab 45

PREREQUISITES:
Organic Chemistry, Physics, Mathematics, Human Physiology, Statistics, Communications, approved courses in economics and management, all Safety Professional courses through SP-10

BRIEF DESCRIPTION:
Management techniques applied to occupational health and safety, direction of programs, selection, supervision and evaluation of technical personnel, establishing objectives and priorities, intra-company relations, securing quality performance. Technical reports required.

TOPIC OUTLINE:	HOURS THEORY	HOURS LAB
Management Concepts Applied to Occupational Health & Safety	2	-
The Occupational Health and Safety Program	3	-
The Safety Professional As A Manager	2	-
Quantitative Concepts In Management	5	-
Decision Making and Establishing Objectives	5	-
Direction of the Occupational Health and Safety Program	3	-
Relationships with Medical Personnel	3	-
Relationships with Production Engineering Personnel	4	-
Relationships with Product Designers	3	-
Relationships with Industrial Hygienists	2	-
Relationships with Regulatory Agencies	4	-
Project Control--Long Term and Short Term	3	-
Company Cost Control and Budgeting	4	-
Managing A Dynamic Occupational Health & Safety Program	2	-
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APPENDIX VII

Suggested
Tasks/Activities
for
Occupational Health and Safety
"Generalist" Curriculum

COURSE OUTLINE

COURSE TITLE: AIR QUALITY FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST	REF. G-1

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

1. Review applicable codes and/or recommend standards to determine compliance. AIR QUALITY. (IH-1, SP-1)
2. Review specifications for existing materials and/or chemicals to identify potential hazards. AIR QUALITY. (IH-2, SP-2)
3. The method of sampling you use to obtain air samples includes: GRAB SAMPLES. (IH-3, SP-3)
4. The method of sampling you use to obtain air samples includes: CONTINUOUS SAMPLES. (IH-4, SP-4)
5. Types of equipment you use for air quality surveys: PERSONAL SAMPLER. (IH-5, SP-10)
6. Types of equipment you use for air quality surveys: CHARCOAL TUBE. (IH-6, SP-11)
7. Select appropriate equipment to use when sampling or collecting data. (IH-23, SP-14)
8. Select the locations where sampling data collection or monitoring is to take place. (IH-24, SP-15)
9. Select the time schedule or time period to be used for sampling, data collection or monitoring air quality. (IH-25, SP-16)
10. Worker exposure monitoring: AIR QUALITY. (IH-26, SP-17)
11. The method of analysis you use to determine the results of air quality monitoring with direct reading instruments. (IH-43, SP-18)
12. In reference to ventilation systems, do you use VELOMETERS? (IH-15, SP-21)
13. In reference to ventilation systems, do you use MANOMETERS? (IH-13, SP-22)
14. In reference to ventilation systems, do you use PSYCHROMETRIC CHARTS? (IH-14, SP-23)
15. Recommend or introduce changes for control of hazards: ISOLATION OF SOURCE. (IH-27, SP-24)
16. Recommend or introduce changes for control of hazards: PROCEDURE CHANGES. (IH-28, SP-25)
17. Recommend or introduce changes for control of hazards: LOCAL EXHAUST VENTILATION (IH-29, SP-26)

COURSE OUTLINE

COURSE TITLE: QIR QUALITY FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST	REF. G-2

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

18. *Recommend or introduce changes for control of hazards:* GENERAL VENTILATION. (IH-30, SP-27)

19. *Recommend or introduce changes for control of hazards:* ENGINEERING CHANGES TO EQUIPMENT. (IH-31, SP-28)

20. *Recommend or introduce changes for control of hazards:* CHEMICAL OR MATERIAL SUBSTITUTION. (IH-32, SP-29)

21. *Recommend or introduce changes for control of hazards:* NEW EQUIPMENT. (IH-33, SP-30)

22. *Recommend or introduce changes for control of hazards:* PROCESS CHANGES. (IH-34, SP-31)

23. *Recommend or ijnroduce changes for control of hazards:* HEALTH/SAFETY TRAINING OF WORKERS. (IH-35, SP-33)

24. *Recommend or introduce changes for control of hazards:* PERSONAL PROTECTIVE CLOTHING. (IH-36, SP-34)

25. *Recommend or introduce changes for control of hazards:* PERSONAL PROTECTIVE EQUIPMENT. (IH-37, SP-35)

26. *Recommend or introduce changes for control of exposures:* INSTALLATION OF CONTINUOUS MONITORING AND WARNING EQUIPMENT. (IH-38, SP-36)

27. *Make recommendations concerning the most appropriate solution(s) to be implemented.* (IH-39, SP-37)

28. *Develop alternate solutions applicable to control an identified hazard(s).* (IH-40, SP-38)

29. *Develop or modify emergency procedures for accidents, injuries, spills, fires, etc.* (AIR QUALITY). (IH-42, SP-39)

COURSE OUTLINE

COURSE TITLE: PHYSICAL EXPOSURES FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST	REF. G-3

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

1. Develop or modify emergency procedures for accidents, injuries, spills, fires, etc. (IH-39, SP-9)
2. Do you evaluate radiation hazards involving WASTE DISPOSAL? (IH-10, SP-13)
3. Do you evaluate radiation hazards involving: TRANSPORT OF MATERIALS? (IH-8, SP-14)
4. Do you evaluate radiation hazards involving: ACCIDENTAL SPILLAGE? (IH-5, SP-15)
5. Equipment which you use to measure thermal exposure includes: AIR VELOCITY INSTRUMENTS. (IH-16, SP-17)
6. Equipment which you use to measure thermal exposure includes: DRY-BULB THERMOMETER. (IH-13, SP-17)
7. Equipment which you use to measure thermal exposure includes: WET-BULB THERMOMETER. (IH-14, SP-18)
8. Equipment which you use to measure thermal exposure includes: GLOBE THERMOMETER. (IH-15, SP-19)
9. Equipment which you use to measure thermal exposure includes: HYGROMETER. (IH-16, SP-20)
10. Do you become involved in thermal exposure problems? (IH-12, SP-21)
11. In reference to the following site facility, do you evaluate and/or recommend controls: HEATING AND COOLING? (IH-42, SP-22)
12. In reference to abnormal pressures do you identify exposures? (IH-18, SP-23)
13. In reference to abnormal pressures do you measure exposures? (IH-19, SP-14)
14. In reference to abnormal pressures do you recommend controls? (IH-21, SP-25)
15. Review applicable codes and/or recommend standards to determine compliance PHYSICAL EXPOSURES. (IH-3, SP-26)
16. Select appropriate equipment to use when sampling or collecting data. PHYSICAL EXPOSURES. (IH-1, SP-27)

COURSE OUTLINE

COURSE TITLE: PHYSICAL EXPOSURES FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST

REF. G-4

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

17. *Select the time schedule or time period to be used for sampling, data collection or monitoring.* PHYSICAL EXPOSURE. (IH-23, SP-28)

18. *Perform calculations necessary to determine if acceptable levels of limits of exposure have been exceeded.* PHYSICAL EXPOSURE. (IH-26, SP-29)

19. *Worker exposure monitoring.* PHYSICAL EXPOSURE. (IH-22, SP-30)

20. *Analyze and interpret the results of sampling or monitoring to determine if correction action is necessary.* PHYSICAL EXPOSURE. (IH-31, SP-25)

21. *In reference to the following site facility, do you evaluate and/or recommend control:* SOLID WASTE DISPOSAL. (IH-43, SP-33)

22. *Recommend or introduce changes for control of hazards:* PROCEDURE CHANGES. (IH-27, SP-34)

23. *Recommend or introduce changes for control of hazards:* PROCESS CHANGES. (IH-28, SP-35)

24. *Recommend or introduce changes for control of hazards:* ENGINEERING CHANGES TO EQUIPMENT. (IH-31, SP-38)

25. *Recommend or introduce changes for control of hazards:* NEW EQUIPMENT. (IH-31, SP-38)

26. *Recommend or introduce changes for control of hazards:* ISOLATION OF SOURCE. (IH-32, SP-39)

27. *Recommend or introduce changes for control of hazards:* INSTALLATION OF CONTINUOUS MONITORING AND WARNING EQUIPMENT. (IH-35, SP-40)

28. *Recommend or introduce changes for control of hazards:* GENERAL VENTILATION. (IH-34, SP-41)

29. *Recommend or introduce changes for control of hazards:* HEALTH/SAFETY TRAINING OF WORKERS. (IH-36, SP-43)

30. *Recommend or introduce changes for control of hazards:* PERSONAL PROTECTIVE EQUIPMENT. (IH-37, SP-44)

31. *Recommend or introduce changes for control of hazards:* PERSONAL PROTECTIVE CLOTHING. (IH-38, SP-45)

32. *Develop alternate solutions applicable to control an identified hazard(s).* PHYSICAL EXPOSURES. (IH-40, SP-47)

COURSE OUTLINE

COURSE TITLE: HAZARDOUS MATERIALS FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST

REF. G-5

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

1. *Review specifications for existing materials and/or chemicals to identify potential hazards.* HAZARDOUS MATERIALS. *(IH-1, SP-1)*
2. *Select appropriate equipment to use when sampling or collecting data.* HAZARDOUS MATERIALS. *(IH-8, SP-2)*
3. *Review applicable codes and/or recommend standards to determine compliance.* HAZARDOUS MATERIALS. *(IH-2, SP-7)*
4. *Select the locations where sampling data collection or monitoring is to take place.* HAZARDOUS MATERIALS. *(IH-9, SP-3)*
5. *Perform calculations necessary to determine if acceptable levels or limits of exposure have been exceeded.* HAZARDOUS MATERIALS. *(IH-10, SP-4)*
6. *Perform calculations necessary to determine if acceptable levels or limits of exposure have been exceeded.* HAZARDOUS MATERIALS. *(IH-11, SP-5)*
7. *Do you review maintenance schedules and procedures to identify hazardous situations for maintenance personnel?* HAZARDOUS MATERIALS. *(IH-6, SP-9)*
8. *Analyze and interpret the results of sampling or monitoring to determine if correction action is necessary.* HAZAROUD MATERIALS. *(IH-13, SP-6)*
9. *Do you identify and/or control hazards in maintenance shop areas?* HAZARDOUS MATERIALS. *(IH-7, SP-8)*
10. *Develop alternate solutions applicable to control an identified hazard(s).* HAZARDOUS MATERAILS. *(IH-15, SP-11)*
11. *Recommend or introduce changes for control of hazards:* PROCEDURE CHANGES. *(IH-16, SP-12)*
12. *Recommend or introduce changes for control of hazards:* CHEMICAL OR MATERIAL SUBSTITUTION. *(IH-17, SP-13)*
13. *Recommend or introduce changes for control of hazards:* PROCESS CHANGES. *(IH-18, SP-14)*
14. *Recommend or introduce changes for control of hazards:* ENGINEERING CHANGES TO EQUIPMENT. *(IH-19, SP-15)*
15. *Recommend or introduce changes for control of hazards:* NEW EQUIPMENT. *(IH-20, SP-16)*

COURSE OUTLINE

COURSE TITLE: HAZARDOUS MATERIALS FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST

REF. G-6

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

16. *Recommend or introduce changes for control of hazards:* ISOLATION OF SOURCE. (IH-21, SP-17)

17. *Recommend or introduce changes for control of hazards:* LOCKOUT PROCESURES. (IH-22, SP-18)

18. *Recommend or introduce changes for control of hazards:* LOCAL EXHAUST VENTILATION. (IH-28, SP-19)

19. *Recommend or introduce changes for control of hazards:* GENERAL VENTILATION. (IH-29, SP-20)

20. *Recommend or introduce changes for control of exposures:* INSTALLATION OF CONTINUOUS MONITORING AND WARNING EQUIPMENT. (IH-30, SP-21)

21. *Recommend or introduce changes for control of hazards:* HEALTH/SAFETY TRAINING OF WORKERS. (IH-31, SP-22)

22. *Recommend or introduce changes for control of hazards:* PERSONAL PROTECTIVE EQUIPMENT. (IH-32, SP-23)

23. *Recommend or introduce changes for control of hazards:* PERSONAL PROTECTIVE CLOTHING. (IH-33, SP-24)

24. *Specity personal protective equipment and clothing to be purchased and used on the job.* HAZARDOUS MATERIALS. (IH-34, SP-25)

25. *Participate in product design review.* HAZARDOUS MATERIALS. (IH-42, SP-26)

26. *Do you make recommendations concerning the transportation of hazardous materials within the plant?* HAZARDOUS MATERIALS. (IH-39, SP-27)

27. *Do you make recommendations concerning the transportation of hazardous materials outside the plant?* HAZARDOUS MATERIALS. (IH-40, SP-28)

28. *Make recommendations concerning procedures, layout and equipment used in laboratories within your organization.* HAZARDOUS MATERIALS. (IH-35,SP-29)

29. *Develop or modify emergency procedures for accidents, injuries, spills, fires, etc.* HAZARDOUS MATERIALS. (IH-41, SP-30)

30. *Develop standards for the organization's product safety program.* HAZARDOUS MATERIALS. (IH-43, SP-31)

31. *Make recommendations concerning product data sheets, operating and assembly instructions, etc., for products produced.* HAZARDOUS MATERIALS. (IH-44, SP-32)

COURSE OUTLINE

COURSE TITLE: HAZARDOUS MATERIALS FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST	REF. G-7

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

32. *Make recommendations concerning specifications and design of products produced by your organization.* HAZARDOUS MATERIALS. (IH-45, SP-33)

33. *Review customer complaints concerning product hazards.* HAZARDOUS MATERIALS. (IH-46, SP-34)

COURSE OUTLINE

COURSE TITLE: FLAMMABLE MATERIALS FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST

REF. G-8

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

1. The method of sampling you use to obtain air samples includes: GRAB SAMPLES. (IH-2, SP-2)
2. Do you perform instrument calibrations using: DYNAMIC CONCENTRATIONS. (IH-4, SP-5)
3. Types of equipment you calibrate: COMBUSTIBLE GAS DETECTOR. (IH-5, SP-4)
4. The method of sampling you use to obtain air samples includes: CONTINUOUS SAMPLES. (IH-3, SP-6)
5. Types of equipment you use for air quality surveys: COMBUSTIBLE GAS DETECTOR. (IH-8, SP-3)
6. Select the locations where sampling data collection or monitoring is to take place. FLAMMABLE MATERIALS. (IH-9, SP-7)
7. Sampling locations you use to obtain air samples include: POINT OF OPERATION. (IH-11, SP-8)
8. Perform calculations necessary to determine if acceptable levels or limits of exposure have been exceeded. FLAMMABLE MATERIALS. (IH-6, SP-12)
9. Sampling locations you use to obtain air samples include the COMMUNITY ENVIRONMENT. (IH-13, SP-9)
10. Review specifications for existing materials and/or chemicals to identify potential hazards. FLAMMABLE MATERIALS. (IH-1, SP-14)
11. Select the time schedule or time period to be used for sampling, data collection or monitoring of FLAMMABLE MATERIALS. (IH-14, SP-10)
12. Select appropriate equipment to use when sampling or collecting data? (IH-15, SP-1)
13. Worker exposure monitoring. FLAMMABLE MATERIALS. (IH-19, SP-11)
14. Review specifications for existing materials and/or chemicals to identify potential hazards. FLAMMABLE MATERIALS. (IH-16, SP-12)
15. Analyze and interpret the results of sampling or monitoring to determine if correction action is necessary. FLAMMABLE MATERIALS. (IH-18, SP-13)
16. Recommend or introduce changes for control of hazards by procedure changes. FLAMMABLE MATERIALS. (IH-21, SP-16)

COURSE OUTLINE

COURSE TITLE: FLAMMABLE MATERIALS FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST

REF. G-9

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

17. *Recommend or introduce changes for control of hazards by process changes.* FLAMMABLE MATERIALS. (*IH-22, SP-17*)

18. *Recommend or introduce changes for control of hazards by chemical or material substitution.* FLAMMABLE MATERIALS. (*IH-23, SP-18*)

19. *Develop or modify emergency procedures for accidents, injuries, spills, fires, etc.* FLAMMABLE MATERIALS. (*IH-20, SP-39*)

20. *Recommend or introduce changes for control of hazards by engineering changes to equipment.* (*IH-24, SP-19*)

21. *Recommend or introduce changes for control of hazards by new equipment.* FLAMMABLE MATERIALS. (*IH-25, SP-20*)

22. *Recommend or introduce changes for control of hazards by isolation of source.* FLAMMABLE MATERIALS. (*IH-26, SP-23*)

23. *Recommend or introduce changes for control of hazards by lockout procedures.* FLAMMABLE MATERIALS. (*IH-27, SP-24*)

24. *Recommend or introduce changes for control of hazards by local exhaust ventilation.* FLAMMABLE MATERIALS. (*IH-28, SP-25*)

25. *Recommend or introduce changes for control of hazards by general ventilation.* FLAMMABLE MATERIALS. (*IH-29, SP-26*)

26. *Recommend or introduce changes for control of exposures by installation of continuous monitoring and warning equipment.* FLAMMABLE MATERIALS. (*IH-30, SP-27*)

27. *Recommend or introduce changes for control of hazards by health/safety training of workers.* FLAMMABLE MATERIALS. (*IH-31, SP-28*)

28. *Recommend or introduce changes for control of hazards by personal protective equipment.* FLAMMABLE MATERIALS. (*IH-32, SP-29*)

29. *Recommend or introduce changes for control of hazar-s by personal protective clothing.* FLAMMABLE MATERIALS. (*IH-33, SP-30*)

30. *Make recommendations concerning the most appropriate solution(s) to be implemented.* FLAMMABLE MATERIALS. (*IH-33, SP-21*)

31. *Develop alternate solutions applicable to control an identified hazard.* FLAMMABLE MATERIALS. (*IH-35, SP-31*)

COURSE OUTLINE

COURSE TITLE: FLAMMABLE MATERIALS FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST	REF. G-10

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

32. *Recommend or introduce changes for control of exposures by installation of continuous monitoring and warning equipment.* FLAMMABLE MATERIALS. *(IH-36, SP-28)*

COURSE OUTLINE

COURSE TITLE: MATERIALS HANDLING FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST	REF. G-11

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

1. *Review accident or injury reports to identify potential hazards and/or analyze for potential cause.* MATERIALS HANDLING. (IH-1, SP-1)
2. *In reference to manual material handling hazards (ergonomic exposures) do you* IDENTIFY? (IH-4, SP-3)
3. *In reference to manual material handling hazards (ergonomic exposures) do you* ANALYZE/EVALUATE? (IH-5, SP-9)
4. *In reference to manual material handling hazards (ergonomic exposures) do you* RECOMMEND CONTROLS? (IH-7, SP-13)
5. *Review specifications for existing materials and/or chemicals to identify potential hazards.* MATERIALS HANDLING. (IH-9, SP-2)
6. *Select appropriate equipment to use when sampling or collecting data.* MATERIALS HANDLING. (IH-12, SP-5)
7. *Select the locations where sampling, data collection or monitoring is to take place.* MATERIALS HANDLING. (IH-11, SP-6)
8. *Review applicable codes and/or recommend standards to determine compliance.* MATERIALS HANDLING. (IH-8, SP-12)
9. *Analyze and interpret the results of sampling or monitoring to determine if correction action is necessary.* MATERIALS HANDLING. (IH-13, SP-11)
10. *Recommend or introduce changes for control of hazards by* PROCEDURE CHANGES. (IH-17, SP-15)
11. *Do you identify and/or control material handling and transportation hazards relative to* CONVEYOR SYTSEMS. (IH-19, SP-32)
12. *Make recommendations concerning the most appropriate solution(s) to be implemented.* MATERIALS HANDLING. (IH-20, SP-44)
13. *Do you use ergonomic principles to modify or design work methods, procedures or workplace layouts?* MATERIALS HANDLING (IH-21, SP-7)
14. *Review written job procedures, methods and practices to identify potential hazards and/or analyze for potential cause.* MATERIALS HANDLING. (IH-22, SP-14)
15. *Do you identify and/or control materials handling and transportation hazards relative to:* CONVEYOR SYSTEMS. (IH-23, SP-16)

COURSE OUTLINE

COURSE TITLE: EDUCATION/TRAINING FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST

REF. G-12

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

1. *Conduct health and safety training sessions.* EDUCATION/TRAINING. *(IH-1, SP-1)*
2. *Do you conduct classroom training sessions?* EDUCATION/TRAINING. *(IH-2, SP-2)*
3. *The types, modes and/or locations of employee education/training which you use includes* RULE BOOKS AND SAFETY MANUALS. *(IH-3, SP-3)*
4. *The types, modes and/or locations of employee education/training which you use includes* SPECIFIC JOB TRAINING. *(IH-4, SP-5)*
5. *Conduct first-aid training for employees.* EDUCATION/TRAINING. *(IH-5, SP-6)*
6. *Do you develop evaluation methods (tests, etc.) to be used in conjunction with health/safety training?* EDUCATION/TRAINING. *(IH-6, SP-7)*
7. *The types, modes and/or locations of employee education/training which you use includes* INDOCTRINATION TRAINING. *(IH-7, SP-10)*
8. *The types, modes and/or locations of employee education/training which you use includes* ENTRY LEVEL TRAINING. *(IH-8, SP-11)*
9. *The types, modes and/or locations of employee education/training which you use includes* COURSES FROM TRADE ASSOCIATIONS. *(IH-9, SP-13)*
10. *The types, modes and/or locations of employee education/training which you use includes* COLLEGES OR UNIVERSITIES. *(IH-10, SP-14)*
11. *The types, modes and/or locations of employee education/training which you use includes* PROGRAMMED LEARNING MATERIAL. *(IH-11, SP-15)*

COURSE OUTLINE

COURSE TITLE: MANAGEMENT TECHNIQUES FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST	REF. G-13

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

1. *Direct the occupational health program for the organization. (IH-1, SP-2)*

2. *Determine staffing requirements, duties and work schedules for health/safety operations. (IH-2, SP-3)*

3. *Select and evaluate performance of health/safety personnel. (IH-3, SP-4)*

4 *Use cost/benefit analysis techniques to compare alternative control methods. (IH-4, SP-5)*

5. *Make recommendations concerning new production processes during the planning phase. (IH-21, SP-22)*

6. *Make recommendations concerning specifications and plans for renovations and new construction. (IH-22, SP-23)*

7. *Analyze the results of such items as physical examinations, biochemical monitoring and autiometric tests, in conjunction with medical personnel. (IH-24, SP-25)*

8. *Develop health and safety training programs.*

COURSE OUTLINE

COURSE TITLE: EVALUATION AND CONTROL FOR THE OCCUPATIONAL HEALTH AND SAFETY GENERALIST	REF. G-14

TASKS/ACTIVITIES AND PERFORMANCE OBJECTIVES:

1. *Conduct walk through inspections to identify potential hazards.*
   AIR QUALITY
   PHYSICAL EXPOSURES
   HAZARDOUS MATERIALS
   FLAMMABLE MATERIALS
   MATERIALS HANDLING
   MECHANICAL AND ELECTRICAL
   FACILITIES
   (IH-1, SP-1)

2. *Observe workers performing specific operations or jobs to identify potential hazards.*
   AIR QUALITY
   PHYSICAL EXPOSURES
   HAZARDOUS MATERIALS
   FLAMMABLE MATERIALS
   MATERIALS HANDLING
   MECHANICAL AND ELECTRICAL
   FACILITIES
   (IH-2, SP-2)

3. *Participate in product design review.* (IH-13, SP-17)

4. *Make recommendations concerning product data sheets, operating and assembly instructions, etc., for products produced.* (IH-14, SP-18)

5. *Make recommendations concerning specifications and design of products produced by your organization.* (IH-15, SP-19)

APPENDIX VIII

Tasks/Activities
Designated to the
Graduate Level

Air Quality - IH (Graduate)

1. *Select appropriate equipment to use when sampling or collecting data.*
2. *Make recommendations concerning the most appropriate solution(s) to be implemented.*

Air Quality - SP (Graduate)

1. *Select appropriate equipment to use when sampling or collecting data.*
2. *Make recommendations concerning the most appropriate solution(s) to be implemented.*

Physical Exposures - IH (Graduate)

1. *Make recommendations concerning the most appropriate solution(s) to be implemented.*
2. *In reference to abnormal pressures* do *you recommend controls?*

Physical Exposures - SP (Graduate)

1. *Make recommendations concerning the most appropriate solution(s) to be implemented.*

Hazardous Materials - IH (Graduate)

1. *Make recommendations concerning procedures, layout and equipment used in offices within your organization.*
2. *Select appropriate equipment to use when sampling or collecting data.*
3. *Analyze and interpret the results of sampling or monitoring to determine if correction action is necessary.*
4. *Make recommendations concerning the most appropriate solution(s) to be implemented.*
5. *Participate in product design review.*

Hazardous Materials - SP (Graduate)

1. *Select appropriate equipment to use when sampling or collecting data.*
2. *Make recommendations concerning the most appropriate solution(s) to be implemented.*
3. *Participate in product design review.*

Flammable Materials - IH (Graduate)

1. *Analyze and interpret the results of sampling or monitoring to determine if correction action is necessary.*

Materials Handling - IH (Graduate)

1. *Worker exposure monitoring.*

2. *Do you use ergonomic principles to modify or design work methods, procedures or workplace layouts?*

3. *Review written job procedures, methods and practices to identify potential hazards and/or analyze for potential cause.*

4. *Do you identify and/or control materials handling and transportation hazards relative to:* CONVEYOR SYSTEMS.

Materials Handling - SP (Graduate)

1. *Worker exposure monitoring.*

2. *Do you use ergonomic principles to modify or design work methods, procedures or workplace layouts?*

3. *Review written job procedures, methods and practices to identify potential hazards and/or analyze for potential cause.*

4. *Do you identify and/or control materials handling and transportation hazards relative to:* CONVEYOR SYSTEMS.

Mechanical and Electrical - SP (Graduate)

1. *Do you use ergonomic principles to modify or design work methods, procedures or workplace layouts?*

2. *Review facility plans, process plans, specifications and drawings to identify potential hazards and/or to analyze for potential cause.*

3. *Review written job procedures, methods and practices to identify potential hazards and/or analyze for potential cause.*

Facilities - SP (Graduate)

1. *Review written job procedures, methods and practices to identify potential hazards and/or analyze for potential cause.*

2. *Plan the location of, equipment for and staff of emergency and disaster operations centers.*

3. *Participate in product design review.*

Education/Training - IH (Graduate)

1. *Do you determine the content for employee health/safety training?*
2. *Do you determine the content to be included in health/safety training?*
3. *Do you develop the course content and materials to be offered for health/safety training?*

Education/Training - SP (Graduate)

1. *Do you determine the content for employee health/safety training?*
2. *Do you determine the content to be included in health/safety training?*
3. *Do you develop the course content and materials to be offered for health/safety training?*

Management Techniques - IH (Graduate)

1. *Direct the occupational health program for the organization.*
2. *Determine staffing requirements, duties and work schedules for health/safety operations.*
3. *Select and evaluate performance of health/safety personnel.*
4. *Make recommendations concerning specifications and plans for renovations and new construction.*
5. *Make recommendations concerning new production processes during the planning phase.*
6. *Use cost/benefit analysis techniques to compare alternative control methods.*
7. *Develop health and safety training programs.*
8. *Analyze the results of such items as physical examinations, biochemical monitoring and audiometric tests, in conjunction with medical personnel.*

Management Techniques - SP (Graduate)

1. *Direct the occupational health program for the organization.*
2. *Determine staffing requirements, duties and work schedules for health/safety operations.*
3. *Select and evaluate performance of health/safety personnel.*
4. *Make recommendations concerning specifications and plans for renovations and new construction.*
5. *Make recommendations concerning new production processes during the planning phase.*

Management Techniques - SP (Graduate)(continued)

6. *Use cost/benefit analysis techniques to compare alternative control methods.*

7. *Develop health and safety training programs.*

8. *Analyze the results of such items as physical examinations, biochemical monitoring and audiometric tests, in conjunction with medical personnel.*

General - IH (Graduate)

1. *Do you use ergonomic principles to modify or design work methods, procedures or workplace layouts?*

2. *Review written job procedures, methods and practices to identify potential hazards and/or analyze for potential cause.*

3. *Plan the location of, equipment for and staff of emergency and disaster operations centers.*

4. *Participate in product design review.*

APPENDIX IX

Typical Job Descriptions

JOB DESCRIPTION

JOB TITLE: **INDUSTRIAL HYGIENE TECHNICIAN**

RESPONSIBILITIES:

1. To conduct or assist in the conduct of periodic investigations, surveys, and monitoring programs for defining substances, conditions, and activities which contribute to contamination of the environment or to potential harmful exposure to personnel.

2. To inspect and repair as appropriate industrial hygiene instrumentation and equipment within the responsibility of the industrial hygiene program and to maintain inspection records on the equipment.

3. To assist in reviewing operating and maintenance instructions and emergency plans for adequacy relative to industrial hygiene precautions.

4. To assist in the conduct of occupational health and safety training activities.

SUPERVISION RECEIVED:

Under direction of Industrial Hygiene Professional or, occasionally, Industrial Hygienist In Training; schedules work to meet designated objectives of industrial hygiene program.

SUPERVISION EXERCISED:

None

QUALIFICATIONS:

EDUCATION -

A minimum of two years college education preferably in a technical or basic science field; an Associate degree is desirable.

EXPERIENCE -

None required; some work experience in any of the corporation's operations is desirable.

OTHER -

None

JOB DESCRIPTION

JOB TITLE: INDUSTRIAL HYGIENIST IN TRAINING

RESPONSIBILITIES:

1. To assist in maintaining the corporation's comprehensive industrial hygiene program covering all areas of environmental and occupational health.

2. To assist in establishing standards and priorities for the industrial hygiene program as determined by management and regulatory agencies.

3. To keep current of all applicable existing, pending, and proposed legislation regarding occupational health and safety. To act as a liaison with the appropriate legislative and regulatory agencies, and to advise the corporation's management on implications of legislation, regulations, and standards.

4. To review and recommend practical methods, operating procedures, materials, hardware, and instrumentation during facility planning and design; to provide adequate environmental and hazardous waste elimination controls and protection of personnel from occupational illness and injuries.

5. To assist in planning and conducting periodic investigations, surveys, and surveillance programs for defining substances, conditions, and activities which contribute to the contamination of the environment or the potential harmful exposures to employees or the public.

6. To analyze existing and anticipated technical problems of possible emission of contaminants or occupational illness or injury exposures and to determine the most economically feasible and effective method of control or abatement.

7. To assist in developing techniques for conducting environmental contamination and industrial hygiene problem studies utilizing the latest technologies and controls for minimizing contaminants and occupational health and safety exposures.

8. To participate in field surveys, monitoring activities and analytical calculations and prepare reports required by applicable officals.

9. To assist in developing methods and standards for effective sampling, flow measurement, chemical analysis, instrumentation, and presentation of data.

10. To develop and maintain appropriate records of sampling and monitoring results.

SUPERVISION RECEIVED:

Under direction of Industrial Hygiene Professional plans and schedules work to meet specific objectives of occupational health and safety program in assigned area of responsibility.

SUPERVISION EXERCISED:

May occasionally supervise industrial hygiene technicians in meeting assigned objectives of occupational health and safety program.

QUALIFICATIONS:

EDUCATION -

A Bachelor's degree in engineering or science; specialized training in industrial hygiene.

EXPERIENCE -

A minimum of ____ years experience in industrial hygiene programs.

OTHER -

None

JOB DESCRIPTION

JOB TITLE: INDUSTRIAL HYGIENE PROFESSIONAL

RESPONSIBILITIES:

1. To implement industrial hygiene policies, procedures, and standards and disseminate information through industrial hygiene supervisory manuals and directives.

2. To advise management at all levels on all matters relating to industrial hygiene.

3. To recognize, investigate, evaluate, eliminate and/or control exposures to environmental occupational hazards affecting employees health and safety and the corporation's facilities and/or community surroundings.

4. To prepare or direct the preparation of reports summarizing the performance of the industrial hygiene program.

5. To assure that employees are trained in identifying and responding to hazardous environmental occupational exposures.

6. To advise the medical and personnel departments on industrial hygiene factors relative to the proper selection and placement of employees.

7. To assure compliance with Federal, state, and local laws, ordinances and orders pertaining to industrial hygiene.

8. To evaluate designs and installations for all new or modified industrial processes and equipment.

9. To establish standards for purchase of safety equipment and apparel to be used by personnel.

10. To administer and manage the control functions necessary to the operation of the industrial hygiene program within his area of responsibility.

SUPERVISION RECEIVED:

Under direction of Industrial Hygiene Administrator or Safety Professional Administrator; receives general policy interpretation and broad instructions in the achievement of specific objectives and work goals; all designs, methods, programs, and recommendations are subject to review.

SUPERVISION EXERCISED:

Supervises staff of 5-10 Industrial Hygienists In Training and Technicians.

QUALIFICATIONS:

EDUCATION -

A Bachelor's degree in science or engineering; specialized training in industrial hygiene.

EXPERIENCE -

A minimum of ____ years experience in industrial hygiene programs, including supervisory experience.

OTHER -

Certified by The American Board of Industrial Hygiene.

JOB DESCRIPTION

JOB TITLE: INDUSTRIAL HYGIENE ADMINISTRATOR

RESPONSIBILITIES:

1. To administer corporate policy and management controls utilizing industrial hygiene and safety engineering practices to measure, predict, and control the loss potential of operations and systems within his area of responsibility.

2. To plan, initiate, and oversee objectives for a long-range occupational health program which complies with statutes relating to the maintenance of safe working conditions.

3. To coordinate efforts with other corporate entities so that appropriate technical and managerial skills are focused on problems relating to the corporation's work or work environments which may actually or potentially affect the health and safety of employees or the community.

SUPERVISION RECEIVED:

Under direction of Director, Health and Safety; minimum immediate supervision; refer only unusual problems to supervisor.

SUPERVISION EXERCISED:

Supervises two or more individuals, one of whom is a certified Industrial Hygienist.

QUALIFICATIONS:

EDUCATION -

A Bachelor's degree in engineering or science and a Master's degree in Industrial Hygiene; specialized knowledge in safety engineering is desirable.

EXPERIENCE -

A minimum of ____ years experience in occupational health and safety engineering programs, including supervisory experience.

OTHER -

Certified by the American Board of Industrial Hygiene.

JOB DESCRIPTION

JOB TITLE: **SAFETY PROFESSIONAL TECHNICIAN**

RESPONSIBILITIES:

1. To conduct or assist in conducting periodic surveys, investigations and surveillance for determining unsafe conditions or practices or to determine the maintenance of safe levels of performance for the protection of employee health and safety and protection of facilities.
2. To review safety evaluation and inspection reports and assist supervisor in coordinating the requested corrective action.
3. To inspect and repair as appropriate safety equipment and to maintain inspection records on safety equipment.
4. To maintain a comprehensive fire equipment maintenance, test, and repair record system.
5. To assist in conducting injury investigations and maintains followup records on recommended corrective action.
6. To assist in reviewing operating and maintenance instructions and emergency plans for adequacy of safety precautions.
7. To assist in the conduct of occupational safety and health training activities.

SUPERVISION RECEIVED:

Under direction of Safety Professional or occasionally, Safety Professional In Training; schedules work to meet designated objectives of safety program.

SUPERVISION EXERCISED:

None

QUALIFICATIONS:

EDUCATION -

A minimum of two years college education preferably in a technical field; an Associate degree is desirable.

EXPERIENCE -

None required; some work experience in any of the corporation's operations is desirable.

OTHER -

None

JOB DESCRIPTION

JOB TITLE: **SAFETY PROFESSIONAL IN TRAINING**

RESPONSIBILITIES:

1. To assist in maintaining the corporations comprehensive occupational safety and health program including fire protection and products.

2. To assist in establishing standards and priorities for the occupational safety and health, fire protection and product safety programs as determined by management and regulatory agencies.

3. To remain current of all applicable existing, pending and proposed legislation regarding occupational safety and health, fire protection and product safety, to act as liaison with the appropriate legislative and regulatory agencies as directed, to advise the corporations management on implications of legislation, regulations and standards.

4. To review and recommend practical methods, operating procedures, materials, hardware and work surveillance during facility planning and design to provide adequate employee and public protection.

5. To assist in planning and conducting periodic evaluations, investigations, surveys, and surveillance programs for defining substances, conditions, and activities which contribute to harmful exposures to employees or the public.

6. To evaluate work areas, to evaluate compliance with occupational safety and health standards and procedures in a wide variety of situations such as housekeeping, exits, machine tool safeguarding, hazardous materials, flammable materials, air contaminants, etc.

7. To analyze each component part of a job for significant exposures and recommend specific methods to correct unsafe conditions or practices.

8. To monitor hazardous operations to ensure adequate safety and health precautions are employed.

9. To advise management of unsafe work conditions and practices and make recommendations for their correction.

10. To investigate accidents and incidents of occupational illnesses to discover cause and contributing factors.

11. To prepare reports of investigations covering all information pertinent to medical treatment, prevention of recurrence of contributing factors, and possible litigation.

12. To evaluate suggestions involving occupational safety and health considering the suggestions objective, application, and feasibility.

SUPERVISION RECEIVED:

Under direction of Safety Professional plans and schedules work to meet specific objectives of occupational safety and helath program in assigned area of responsibility.

SUPERVISION EXERCISED:

May occasionally supervise safety professional technicians in meeting assigned objectives of safety program.

QUALIFICATIONS:

EDUCATION -

A Bachelor's degree in engineering; specialized training in safety engineering.

EXPERIENCE -

A minimum of ____ years experience in safety engineering programs.

OTHER -

None

JOB DESCRIPTION

JOB TITLE: **SAFETY PROFESSIONAL**

RESPONSIBILITIES:

1. To implement safety policies, procedures, and standards, and disseminate information through engineering and supervisory safety manuals and directives.
2. To advise management at all levels on all matters relating to safe operations and products.
3. To maintain or direct the maintenance of an accident record system and to prepare or direct the preparation of reports summarizing the performance of the safety program.
4. To assure that employees are trained in all phases of accident prevention and occupational health.
5. To advise the medical and personnel departments on safety factors relative to the proper selection and placement of employees.
6. To evaluate facilities and operating conditions to discover and secure correction of hazardous exposures and unsafe work practices.
7. To assure compliance with Federal, state, and local laws, ordinances, and orders pertaining to occupational safety and health, fire protection and products.
8. To evaluate designs and installations for all new or modified equipment, processes or facilities.
9. To establish standards for purchase of safety equipment and apparel to be used by personnel.
10. To administer and manage the control functions necessary to the operation of the safety program within his area of responsibility.

SUPERVISION RECEIVED:

Under direction of Safety Professional Administrator or Industrial Hygiene Administrator; receives general policy interpretation and broad instructions in the achievement of specific objectives and work goals, all designs, methods, programs, and recommendations are subject to review.

SUPERVISION EXERCISED:

Supervises staff of 5-10 engineers and technicians.

QUALIFICATIONS:

EDUCATION -

A college degree in engineering; specialized training in safety engineering.

EXPERIENCE -

A minimum of ____ years experience in safety engineering programs, including supervisory experience.

OTHER -

Certified by the Board of Certified Safety Professionals.

JOB DESCRIPTION

JOB TITLE: **SAFETY PROFESSIONAL ADMINISTRATOR**

RESPONSIBILITIES:

1. To administer corporate policy and management controls utilizing occupational health and safety engineering practices to measure, predict and control the loss potential of operations and systems within his area of responsibility.
2. To plan, initiate, and oversee occupational health and safety engineering programs within his area of responsibility to insure compliance with statutes relating to the maintenance of safe working conditions.
3. To coordinate efforts with other corporate entities so that appropriate technical and managerial skills are focused on problems relating to the corporation's work or work environments which may actually or potentially affect the health and safety of employees or the community.

SUPERVISION RECEIVED:

Under direction of Director, Health and Safety; minimum immediate supervision; refer only unusual problems to supervisor.

SUPERVISION EXERCISED:

Supervises two or more individuals, one of whom is a Certified Safety Professional.

QUALIFICATIONS:

EDUCATION -

A college degree in engineering or science, specialized training in safety engineering and industrial hygiene.

EXPERIENCE -

A minimum of ____ years experience in occupational health and safety engineering programs, including supervisory experience.

OTHER -

Certified by the Board of Certified Safety Professionals.

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